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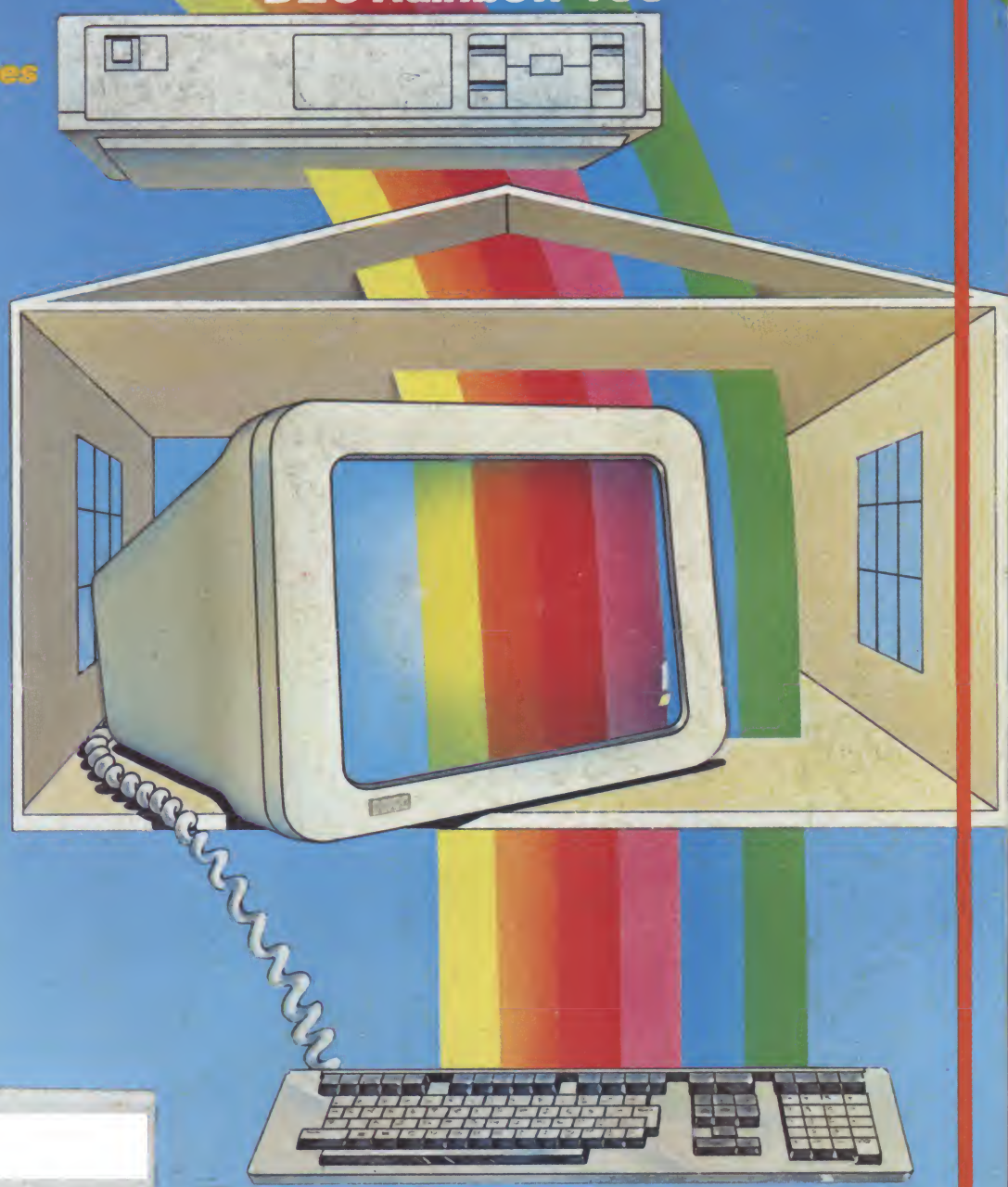
Ada, Pilot, Pascal: How Best to Use Them

Feature Review: DEC Rainbow 100



Focus on Computer Languages

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- Graphics
- Logo
- Books

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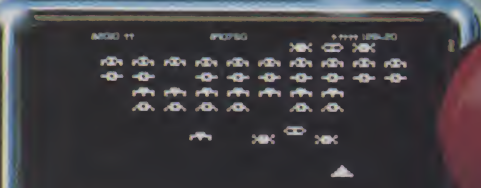

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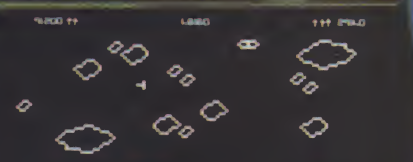

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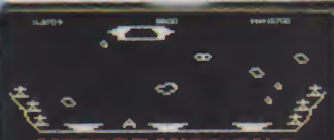

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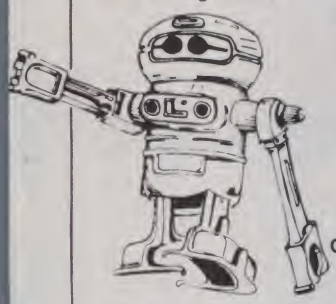

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utput...input/output...input

Not So, Good

Dear Editor:

After reading Phillip Good's review of the Atari Word Processors in the June issue of *Creative Computing* I'm sure that many Atari owners started to gnash and wail. Take heart, folks, it's not as bad as Mr. Good implies.

Now I don't know about the *Letter Perfect* or *Text Wizard* word processors, but I do know about Atari's, because I bought one a day ago in spite of his review.

In his review he makes several mistakes: You *can* use a Centronics 739 or the new Smith-Corona TP-1 (which I'm sure Smith-Corona considers to be letter quality) Printer. He also implies that the tutorials are hopeless. Gosh, how did I learn to use it in about two hours from those hopeless tutorials? Also he says there is no back-up. Maybe they just made a mistake when one was included in my package.

Now I'm no expert. I haven't reviewed 70 zillion word processors as Mr. Good has, but it appears to me that your like of one word processor over another is akin to taste in clothes or interior decoration. There is certainly no accounting for taste.

My advice to those poor Atari owners who want word processing would be as follows: Get it. If you're like me and love to write (or must write in your job) and can't type well (or type superbly), get it. If you just started using computers, the documentation, taped lessons, and exercises with the Atari software will help immensely.

I warn you that I'm from Oklahoma, don't drive a Ferrari and can only afford beer most of the time. My house is modest and so is my expertise, and I can't afford $15,000 for a top of the line word processor, but I can say, positively, that the *Atari Word Processor* (even with its limitations) is a joy to use.

James Forrest Dearner Jr.
2405 N.W. 17th
Oklahoma City, OK 73107

It has always been the policy of Creative Computing to encourage reviewers to make judgments and express opinions about the products they evaluate. We also encourage them to put their opinions in context so readers will know from what point of view the judgments are made. Indeed, taste in word processors varies widely among computer users, and Mr. Good apparently has quite different taste from some of our other readers.—EBS

Let's Get Normal

Dear Editor:

In the April 1982 *Creative Computing* (Page 176) Marvin Weingast suggests an interesting method for approximating a normal distribution. Unfortunately his program does not do what he describes.

He says, for example, that 12.35% of the time X = 1.5*(A+B-1) where A and B are uniformly distributed random variables which vary from 0 to 1. But in the program line 50 he uses A to determine the times when this formula should be used. Thus, to get to X = 1.5*(A+B-1) A must be between .8765 and 1. B still varies between 0 and 1. The resulting distribution is quite different from that intended.

The variable used for the test must be independent of the values used in the functions.

To correct the program:

In Line 30 Add D=RND(1)

Change lines 40 and 50 to read

```
40 IF D< .8765 THEN X=2*(A+B+C-1.5)
50 IF D=> .8765 THEN X= 1.5*(A+B-1)
```

J.K. Quermann
1431 Plowman Ave.
Dallas, TX 75203

Mr. Quermann is correct, and the minor change he suggests is all that is needed, although as you can see from the curve in the article this error had little effect.

By the way, I received a few calls from readers who apparently empirically modified the equations in order to simulate different weapon firing characteristics or operator skill levels in various games.—M. Weingast

New Line Up

Dear Editor:

When running the Mu-Torere program for the Apple II (August 1982) by Sandy Greenfarb, I found that the numbers and the squares on the video display did not line up, making it somewhat confusing to play the game.

By changing line 2080 from:

```
IF I < > 0 THEN VTAB 6: HTAB 5+3*I
```

to

```
IF I < > 0 THEN VTAB 6: HTAB 6+2*I
```

It is an otherwise enjoyable program to use. Thank you, Sandy!

Herbert J. Lango
PSC 1 Box 1179
Brooks A.F.B., TX 78235

Tweeter Beater

Dear Editor:

I really enjoyed the joystick article in the August '82 issue of *Creative Computing*. It is this kind of exhaustive reporting that is of true benefit to your readers.

The Happ Hi-Fi Adapter certainly sounds like a worthwhile solution to the Apple "squeeker-speaker" problem. As is so

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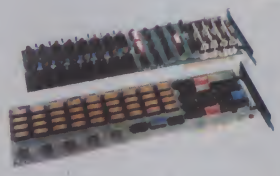

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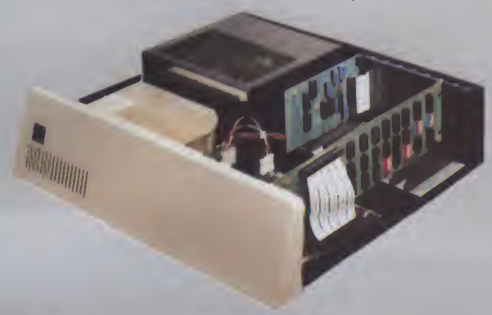

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CIRCLE 302 ON READER SERVICE CARD

utput...input/output...input

often the case, there is a software alternative as well. The cassette output port can be connected to your hi-fi system or run thru a separate low-cost amp+speaker setup. This port is then "live" and all that remains is to toggle it instead of the speaker output.

In a Basic program this will usually consist of replacing an instruction that looks like:

100 POKE 49200,## with: 100 POKE 49184,##

For machine language programs the modification is to instructions like:

100 BIT #$C030 to read: 100 BIT #$C020

It isn't always practical to modify purchased software, and therefore that Happ adapter is still a quite neat device to have, especially at its reasonable price.

The CEEMAC (Visual Composition) language solves this problem by always hitting both ports and providing the user with a "soft switch" to omit toggling the Apple speaker at the user's descretion. If the cassette output port is dead (not connected), nothing is lost as the signal simply falls away.

Although not game nuts, we, at Vagabondo, find *Creative Computing* to be tops in reporting the goings on in personal computing. Keep up the good work!

Brooke W. Boering
Vagabondo Enterprises
1300 E. Algonquin -3G
Schaumburg, IL 60195

It Worked for Iacocca

Dear Editor:

The subjects of software piracy and over-priced programs have been much talked about, often together because they appear to be linked. Here's an open suggestion to software vendors. Maybe it's not directly useable as-is, but it might provide a starting point for discussions of alternatives.

The suggestion is this: when a vendor offers a new product, price it high enough to make a reasonable profit even if it doesn't sell too well. Then, if it does turn into a good seller, lower the price, and send partial rebate checks to the first customers. (One hundred—one thousand—whatever is reasonable.) Or send significant discount coupons on other software.

The plan offers these advantages:

1. People would presumably be less inclined to allow copying of their purchase if they were decreasing their chances of a rebate check.

2. People would have no reason to delay because of hopes that the price will come down. Sales might start sooner.

3. It doesn't penalize those customers the vendor needs most—the first ones.

John E. Stith
P.O. Box 7463
Colorado Springs, CO 80933-7463

tices...notices...notic

NCC '83

The 1983 National Computer Conference will be held May 16-19, 1983 at the Anaheim and Disneyland Hotel Convention Centers.

For more information, contact AFIPS, 1815 N. Lynn St., Arlington, VA 22209. (703) 558-3624.

Siggraph '83

The Tenth Annual Conference on Computer Graphics and Interactive Techniques will be held in Detroit, MI, July 25-29, 1983.

For registration information, contact the Siggraph '83 Conference Office, 111 East Wacker Dr., Chicago, IL 60601. (312) 664-6610.

The conference is sponsored by the Association for Computing Machinery's Special Interest Group on Graphics.

Heart Health Contest

The American Heart Association in conjunction with *Classroom Computer News* has announced a "Heart Health Computer Programming Contest" to solicit the development of programs on health education for eventual national distribution to schools.

Programs should be aimed at an elementary, junior high, or high school audience, and should deal with ways in which heart disease can be prevented. The best program entry has the potential to receive $1500; eleven other entries may receive $500. Programs are to be written in Basic language to run on the Apple, Atari, TRS-80, Texas Instruments or the Commodore PET microcomputers. All entries must be received by January 31, 1983. A panel of computer and education experts will act as judges and reach a decision by spring 1983.

For further information, write to "Heart Health Computer Programming Contest," American Heart Association, Greater Boston Division, 33 Fourth Ave., Needham, MA 02194, before December 1, 1982.

Corrections

We gave an incorrect address for CJM Industries in our Joystick review in the August 1982 issue (page 88). The proper address for ordering the Microstik is: CJM Industries, P.O. Box 436, Sterling, VA 22170.

The Atari customer service department phone numbers we published in the August 1982 issue were incorrect. The correct numbers are: in California, (800) 672-1404; in the rest of the U.S., (800) 538-8543.

THE LEADING EDGE IN PRINTERS

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Finally, there's one full family of printers that covers every business or word processing application—all from C. Itoh, a company known for packing more product into less price; and all distributed exclusively by Leading Edge, a company known for searching out and providing that very thing. Which means that one call to one source can get you any printer, any time you need it, for any purpose. All backed by a full years' warranty from Leading Edge. (Try *that* on any other line of printers.)

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THE STAR.

The Starwriter F-10. In short (or more precisely, in a sleek 6″ high, 30-pound unit), it gives you more of just about everything—except bulk and noise—than any other printer in its price range. It's a 40 cps letter-quality daisy-wheel with a bunch of built-in functions to simplify and speed up word processing. It plugs into almost any micro on the market, serial or parallel.

THE MASTER.

The Printmaster F-10. Does all the same good stuff as the Starwriter except, at 55 cps, the Master does it faster.

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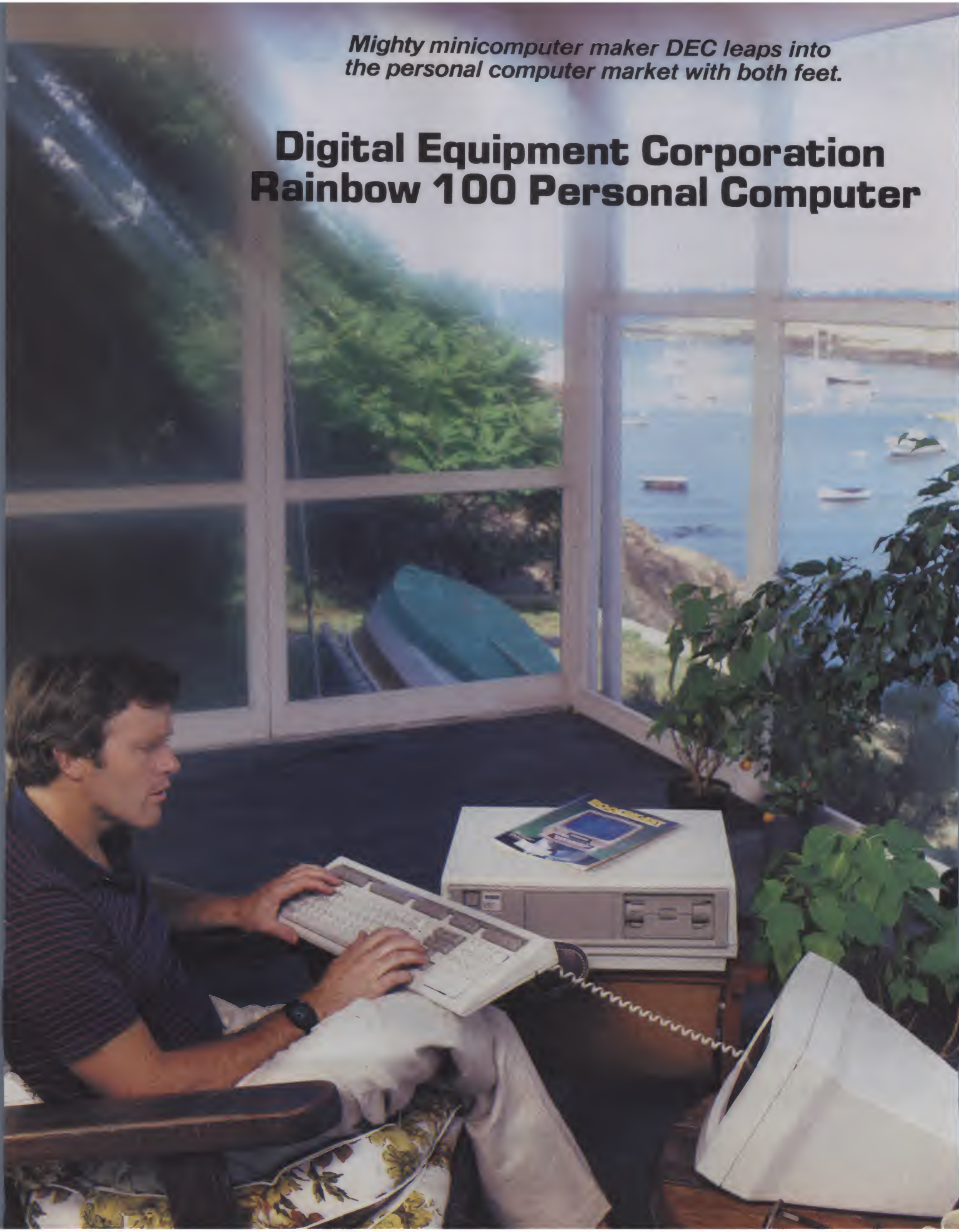
CIRCLE 199 ON READER SERVICE CARD

Mighty minicomputer maker DEC leaps into the personal computer market with both feet.

Digital Equipment Corporation Rainbow 100 Personal Computer



David H. Ahl

It was with mixed feelings that I boarded the 7:00 a.m. People Express flight to Boston. I was looking forward to returning to DEC, my employer from 1970 to 1974. I hoped to see some familiar faces and perhaps review some old memories. On the other hand, my main mission was to do an in-depth evaluation of the Rainbow 100 Personal Computer. Could I do an adequate job?

For the past few years I have been lulled into a sense of complacency by using the same few computers to meet most of my needs. In my office I have a TRS-80 Model III which I use mainly for word processing with *Electric Pencil* and financial chores with *VisiCalc*. At home I have an Apple on which I run mostly *VisiPlot*, *Executive Briefing System* and games. My kids have a TRS-80 Color Computer on which they are learning to program. At *Creative Computing* we have one or two of nearly everything else—Atari, IBM, Vic-20, Pet, Sinclair, NEC, and a bevy of S-100 CP/M systems.

However, with the exception of occasional use of an Altair 8800 (later hatched into an IMSAI) some three years ago, I have rarely touched CP/M—not that I was ever an expert on it. Hence, my trepidation facing a sophisticated new computer boasting CP/M as its operating system.

The weather in Boston did nothing to calm my stomach. Torrential rain and strong gusts of wind buffetted my rented Datsun as I drove out to the new Mt. Royal (Marlboro) facility into which DEC had moved their Terminals and Personal Computer Groups just a few months earlier.

Pete Sanborn, manager of marketing communications for the new Personal Computer Group greeted me and showed me to the demonstration room. A light, airy room as big as any three offices at Creative was the home for four lonely-looking computers. The room is normally very busy with demonstrations, but I was fortunate to be visiting during Comdex and few demonstrations were scheduled. Thus, I nearly had the place to myself.

This was a mixed blessing. For an hour or more, Pete searched in vain for someone who could show me how the system worked. "Never mind," said I. "I don't want a canned demo. Just give me a manual and let me learn it on my own."

Unfortunately, that was even more difficult. As Bob Montemerlo, product marketing manager, explained to me later, the system is still in "final development." This means that the "firmware" or the ROMs containing the system software are still being changed and modified, a process that will continue right up until volume shipments begin in October.

Rainbow 100 uses both an 8-bit Z80 and a 16-bit 8088 with shared memory, disks and I/O.

This isn't as bad as it sounds. The current system works fine and is apparently bug free, but the software engineers are trying to wring the maximum performance from it. The bad news for me, however, was that virtually no documentation currently existed, and the little that did was in extremely preliminary form.

The DEC Heritage

While Pete was searching for the "right" people, I had the opportunity to speak with Andy Knowles, vice president group manager—whatever that means! It is a bit more pretentious title than Andy had when I worked for him some 12 years ago. In those days, the whole company fit into the old woolen mill in Maynard, but that's a story for another time.

In any event, Andy has the overall responsibility for the new personal computers at DEC. When asked why DEC hadn't entered the market earlier, Andy said it was simply a matter of the technology not having "come together" to permit volume production of high quality systems with all the desired features.

Also, DEC has a history of producing as much as possible of their systems in-house. When entering a new technology, they occasionally buy components or peripherals outside, but by the time volume production is reached, DEC is usually producing the item(s). Andy was proud that virtually all the components of the personal computers are produced in-house, and he seemed almost apologetic that Winchester disk drives were being furnished by Seagate.

DEC is entering the personal computer market with a rather different philosophy than practically any other vendor including IBM. From a hardware standpoint, DEC makes more peripherals and components internally than any microcomputer manufacturer.

A printer rolls off a DEC assembly line every 45 seconds, a CRT every minute. Make no mistake about it, this is high

volume production! Hence, DEC has little need for other hardware or peripheral manufacturers, even on an OEM basis, in order to offer complete systems. Even giant IBM was forced to purchase printers from Epson on an OEM basis and, to this day, does not offer a letter-quality printer. DEC, on the other hand, was able to offer three printers when the systems were first announced.

Four DEC personal computers share the same skin, but underneath they are quite different.

Brief digression: Although this is a review of the Rainbow 100, I occasionally speak of systems (with an "s"). In fact, DEC announced four personal computers, the Rainbow 100, Decmate II, Professional 325 and 350. I hesitate to call them a family. While they all use the same keyboard, CRT and system unit/disk housing, under the skin they are quite different. The Rainbow 100 uses two microprocessors (an 8088 and Z80), the Decmate II uses a 6120 (PDP-8 on a chip), and the Professional series is built around an F11 (PDP-11/23). Thus, while some hardware and peripherals can be shared, software is not compatible across the different machines.

Photo 2. The low-profile keyboard is a long 21 inches because of the control keys (center) and numeric keypad (right).

Ergonomic, Low-Profile Keyboard

The first thing that impressed me upon seeing the IBM Personal Computer was the ergonomic design, particularly the low profile, separate keyboard, previously available only on upper end terminals and minicomputers. (Andy Knowles was quick to point out that DEC had been offering a detached keyboard for the past three years with the VT-100 terminal.) The IBM keyboard is nice, but in the DEC keyboard it has certainly met its match.

The low profile DEC keyboard unit measures a long 21" x 6.75". It slants from 0.6" in height at the front to 2" at the rear. The extra length is necessary to hold at the far right a numeric keypad which includes four program function keys, three punctuation marks, and an ENTER key. The program function keys may be defined in software as numeric operators, but don't have to be. In addition, between the alphabetic keyboard and the numeric keypad is a set of ten keys for cursor movement and word processing manipulation. Only the cursor control keys work with the Rainbow 100; the others are for the larger systems.

Along the top row of the keyboard are 20 function keys above which is a removable label strip beneath a hinged plexiglass cover. In total, 36 keys are firmware or software driven. In all, the keyboard has 103 keys. Their matte finish with dark-on-light legends diminishes glare and insures positive finger placement. Although the DEC promotional literature boasts that "proper arrangement of keys can help eliminate errors," I found that the "extra" key (with greater and less than symbols) located between the SHIFT and Z at the bottom left kept masquerading as the SHIFT. As a result, before correction, this paragraph, as did most of the others, started "<along . . . " I also found it curious that the "5" on the numeric keypad was not identified by a raised dot for quick finger placement.

Other than those two minor glitches, the keyboard is as near perfect as I have seen. It is exactly the right height for those who prefer the low-fatigue, palm-on-table typing style and, indeed, meets the European standard of having the home row keys 30mm above the table surface. The keys all provide excellent tactile and aural feedback (a low-volume keyclick reproduced by the self-contained speaker).

The keyboard has its own 8-bit microprocessor, 4K ROM and 256 bytes of RAM. It connects to the CRT display screen with a coiled 6' cable using telephone-type modular connectors.

Photo 1. Andy Knowles and Rainbow 100. Sorry my Olympus was fooled by the light from the windows at the right. But the computer came out well.

Display Screen

Upon seeing the CRT display screen, I thought, "gee, that's small." However, it is not the screen that is small—it is a standard 12" diagonal CRT—but the housing. The housing measures a diminutive 11.5" high by 13.75" wide by 12.25" deep. Most other housings are 25% larger. A balancing leg on the bottom of the housing allows it to be tilted from 25 degrees back to 5 degrees forward (for use on an overhead shelf perhaps?).

Normal display mode is white characters on a black background. Yes, black. None of this light green on dark green or yellow on black. A reverse mode will

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CIRCLE 202 ON READER SERVICE CARD

Monitor and Disk drives not included
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Photo 3. The screen has a matte black finish with white type.

display black on white. The surface of the screen is covered with a non-glare finish. While it needed an occasional wiping, the absence of glare was almost uncanny; I found myself wanting to touch it to reassure myself that it was really glass. However, it is highly susceptible to oily finger prints which destroy the non-glare property and are exceptionally annoying until wiped off.

The display generates 7 x 9 pixel characters including a two pixel descender for g, j, p, q, and y. Screen flicker is reduced by a 60-image-per-second refresh rate; I must confess that I could not see any difference between this display and the Model III or IBM. Normally, 80 characters by 24 lines are displayed, however, it is possible to select (in software) a 132-column width. While this is useful for looking at, say, 12 months of a spreadsheet, the 5 x 9 pixel characters used in this mode are tiring to view for long periods. Nevertheless, it is valuable to be able to preview the entire 14" line printer width.

Other software-selectable features include a split screen capability which allows portions of the 24-line screen to be scrolled separately for menu selections, messages or prompts. The *Select* word processing package (covered later) holds three lines of prompts at the top of the screen while 21 lines at the bottom hold the scrolling text.

Also available are full- and split-screen horizontal and vertical scrolling. Double-height lines and double-width characters let one add emphasis to sections of text. Or, for even more emphasis, bold, blinking, reverse-video and underline are available.

The standard Rainbow 100 includes monochrome (B&W) "character cell" video. For some extra dollars, it can be converted to a bit-map display for either monochrome or color output. This optional mode supports 16 colors simultaneously in the low resolution mode of 320 x 240 pixels or four colors from a palette of eight in the high-resolution mode of 800 x 240 pixels. Color is via an RGB output (three separate outputs for red, green and blue) rather than NTSC composite video.

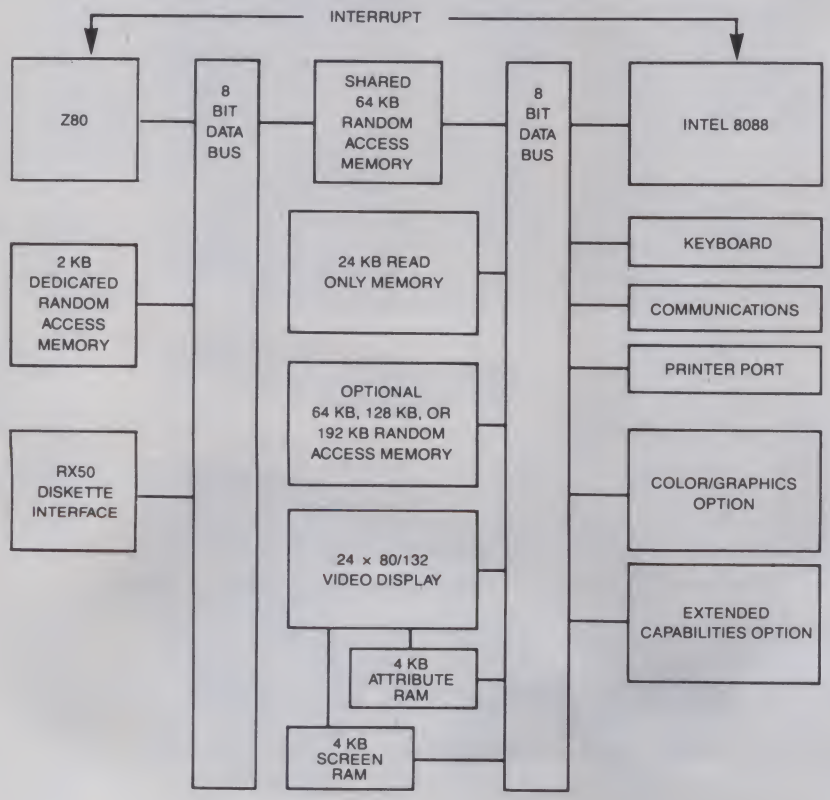


Figure 1. Rainbow 100 System Block Diagram.

System Unit and Disk Drives

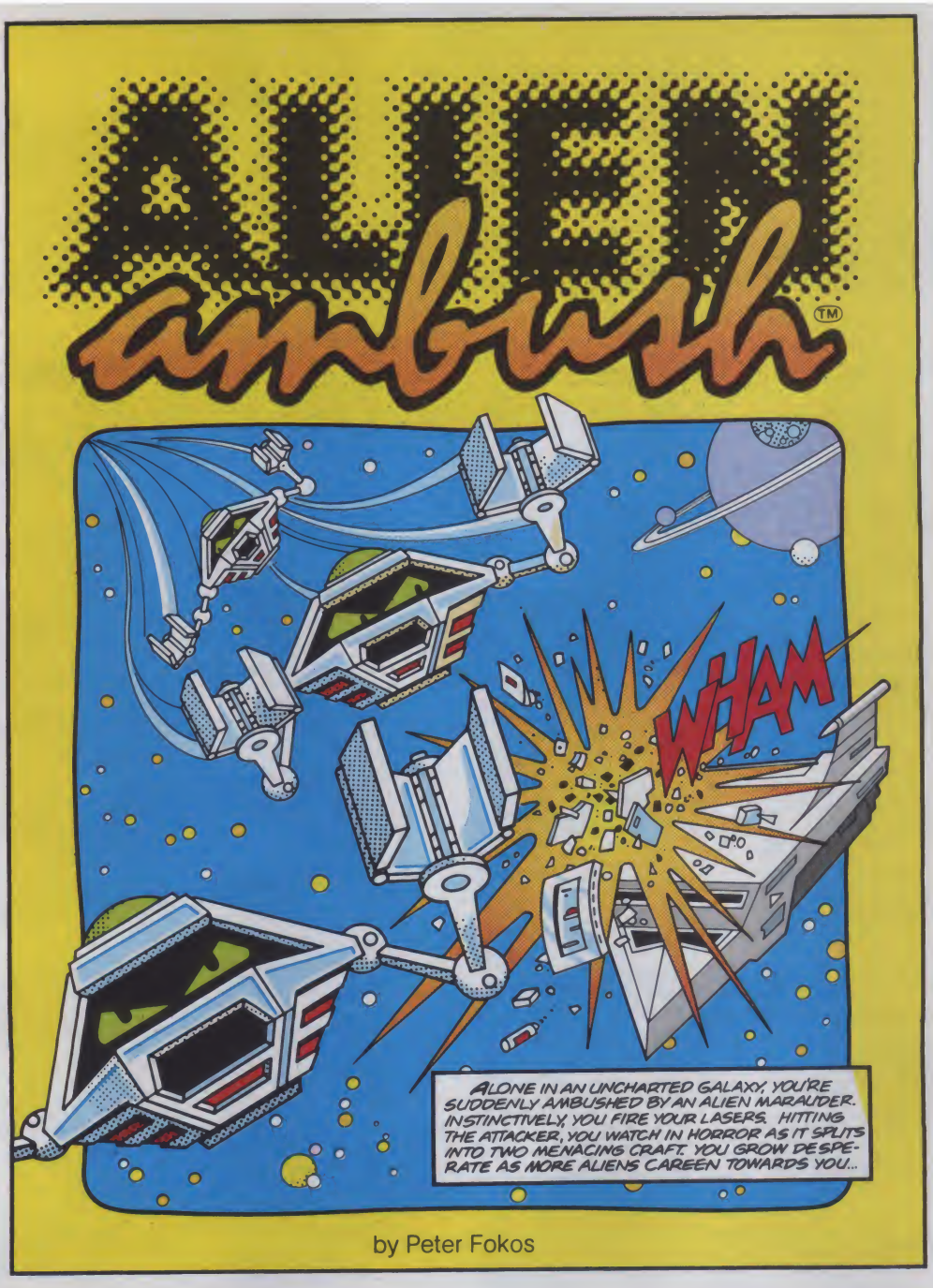
The system unit contains the microprocessors and logic circuitry, power supply, disk drives, and slots for adding optional devices. The unit is designed to be positioned either horizontally on the floor or vertically on a desk or shelf. The unit is relatively large, measuring 19" wide (shades of the rack mount days) by 15" deep by 6" high (assuming vertical mounting).

The disk drives are unique. Looking like no others, each drive accomodates two single sided 5 1/4" diskettes on a single spindle. Each disk stores 409.6K bytes. With two disks on each drive, this gives a total of 819K bytes of storage per drive, considerably more than any other currently-available small computer. Contrast this to the IBM Personal Computer, for example, which stores only 160K bytes per drive; the Rainbow stores five times as much!

Each system unit can accomodate two drives (four disks). For those concerned with specifications, here they are: single sided, 96 tracks per inch, 80 tracks used for storage, 10 sectors per track, 512 bytes per sector, 300 revolutions per minute.

The Rainbow 100 contains two microprocessors, an 8-bit Z80 and a 16-bit 8088. The two processors divide system function—disk operations are controlled by the Z80, while the display, keyboard, I/O port and options are controlled by the 8088. Both processors share 64K bytes of main memory. This may be expanded to 128 or 256K bytes. (See Figure 1).

To take advantage of the dual processors, DEC created a hybrid 8-bit CP/M 80 and 16-bit CP/M 86 operating system called CP/M 86/80. This system features a capability called "soft sense"which allows CP/M 80 and CP/M 86 application programs to run on the Rainbow 100 without operator intervention. The CP/M 86/80 operating system automatically determines if the application is an 8-bit or 16-bit program and executes the instructions with the appropriate processor and operating system.



You haven't lived until you've died in space.

And here's your chance.

Software author Peter Fokos has created Alien Ambush, a space age nightmare. This hi-res, full-color arcade game is written completely in assembly language to give those nasty aliens every advantage.

So if you have access to a 48K Apple* with DOS 3.3, and you're hot for some new thrills, Alien Ambush was written for you. But be warned: It just got a lot tougher to survive in space.

Available at finer computer stores everywhere. *Apple is a trademark of Apple Computer, Inc.
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CIRCLE 211 ON READER SERVICE CARD

Introducing Spinnaker. We make learning fun.

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At Spinnaker Software, we make educational games that are actually fun.

Because they're fun, your children will use them. Instead of letting them collect dust in the basement.

And because your children use them, they'll be learning. And after all, isn't that what educational games are all about?

Our games are educational, because you can't kid parents.

As a parent, you're probably very concerned with how much time your kids spend playing mindless video games.

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All our games have true educational value. They help develop a child's learning skills. And that's something your kids can take with them wherever they go.

Our games are fun, because you can't kid kids.

Kids like Spinnaker games for the same reasons they like roller coasters, going to the beach and ice cream sundaes.

They're fun. Lots of fun. So much fun your kids will probably forget they're learning.

Our games make the computer screen come to life. With colorful graphics, animation and sound.

And they're easy to use. In fact, a lot of our games are easy enough for kids who've never even used a computer before.

How do we make our games both educational and fun?

We're glad you asked.

Educators and game programmers write our software.

Educators, because they've been in the classroom and know how children learn. And what it takes to keep their interest.

Game programmers, because they know how to have fun with computers. These programmers give our games the high resolution graphics, animation and sound that make them so entertaining.

And right now, we're introducing four new games that can be played on the most popular computers, Apple,® Atari,® and IBM.®

First, there's FACEMAKER. It's for young computer users, kids ages 4-8. FACEMAKER helps children improve memory and concentration and provides familiarity with the computer.

Another game for young users is STORY MACHINE. This game lets children ages 5-9 write their own stories and see them acted out on the screen. STORY MACHINE helps children learn to write correctly and acquaints them with the keyboard.

Our SNOOPER TROOPS™ detective series gives your child mysteries to solve. As a Snooper Trooper, your child will have to do some daring detective work, including crawling through dark houses and talking to mysterious agents.

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All four games are available in stores today.

With Spinnaker products, you can rest easy knowing your children are spending their time wisely.

So ask your retailer about the growing line of Spinnaker games.

Because one of the smartest things parents can do is help their children learn.

SPINNAKER™

We make learning fun.

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Rainbow 100 has a built-in asynchronous/byte synchronous communications port that supports speeds up to 9600 baud with modem control. It is also equipped with a serial RS-232C printer port with programmable baud rates, parity bits, etc. for supporting a wide variety of printers as well as the three printers offered by DEC.

Optional Winchester Disk

The optional Winchester disk is housed in a separate cabinet and provides an additional five megabytes of fast-access, auxillary memory. The system consists of a 5 1/4" formatted disk.

Average access time with the Winchester Disk is 95 msec and transfer rate is 5 Mbits/sec compared to 290 msec and 250K b/s for the floppy disk system. Thus access time is three times as fast and transfer rate is 20 times as fast, a noticeable difference.

We are told that because of the sealed head/disk assembly, the drive requires no preventive maintenance or adjustments. Furthermore, the Winchester subsystem has firmware diagnostics that test and verify that all components of the system are working during power-up. These diagnostics also provide continuous error checking during normal operation.

The Rainbow 100 requires the extended communications option which contains a high-speed disk interface port to use the Winchester disk option. This communications option also contains an additional communications port.

Three Printers

DEC offers a choice of three printers with the Rainbow 100: the LA50 Personal Printer, the Letterprinter 100, and the LQP02 Letter-Quality Printer.

Each printer can accomodate a variety of papers: single sheet (such as letterhead), fanfold continuous paper, multipart forms, roll paper and labels. Each printer also contains internal diagnostic tests that are performed automatically on power-up. Also, all three have a local-mode self-test.

The LA50 is a dot-matrix printer with two print modes: text mode and enhanced print mode. In text mode it prints at 100 characters/second. The enhanced mode prints at 50 char/sec and creates a crisper, more uniform character than text mode. The seven-wire printhead allows for underlines and full descenders. The LA50 also prints double-width characters.

In addition, the LA50 prints bit-map graphics at 144 x 72 dots per inch. These dots are printed exactly as the pixels are displayed on the screen.

The LA50 can be set to three character-per-inch spacings: 10, 12 or 16.5. Also, lines-per-inch can be set to 6, 8 or 12. Maximum paper width is 10" although with the compressed character spacing, 132 characters can be printed (in 8"). Normal print width is 80 or 96 columns.

The Letterprinter 100 is a highly versatile dot matrix printer with three user-selectable or program-selectable print speeds for different quality output.

For rough drafts, internal memos or data processing, 240 characters per second produces good, clear text and numbers. The 8-character-per-second mode uses a denser dot pattern for each character and provides higher definition. In the 30-character-per-second correspondence mode, the printer overlaps two sets of dots and produces letter quality text.

The Letterprinter 100 can be placed in graphics mode at any point under software control; this allows the mixing of text and graphics on the same page. In graphics mode it prints 133 x 72 dots per inch.

For maximum creativity in designing a document, you can specify characters per inch (5, 6, 6.6, 8.25, 10, 12, 13.2, or 16.5), lines per inch (2, 3, 4, 6, 8, or 12) as well as margins, tabs and form length. These parameters can be stored in the non-volatile memory of the Letterprinter 100.

A neat feature of Letterprinter 100 is its ability to handle up to five internal character fonts. Courier-10 and Orator-10 are built into all printers. Three additional fonts can be field installed (they are on ROM chips) or you can get additional fonts on plug-in cartridges. The fonts can be changed any time during printing.

Thus by combining different fonts with expanded/compressed character widths and graphics printing—even on a single line—you can be very creative indeed. However, as I remarked in my review of Lotus *EBS*, combining too many type styles and shapes on a single sheet (or slide) does not generally lead to a visually pleasing image. On the other hand, having this exceptional versatility available on the Letterprinter 100 means that you can select just the right style for virtually any document. An example of the fonts and

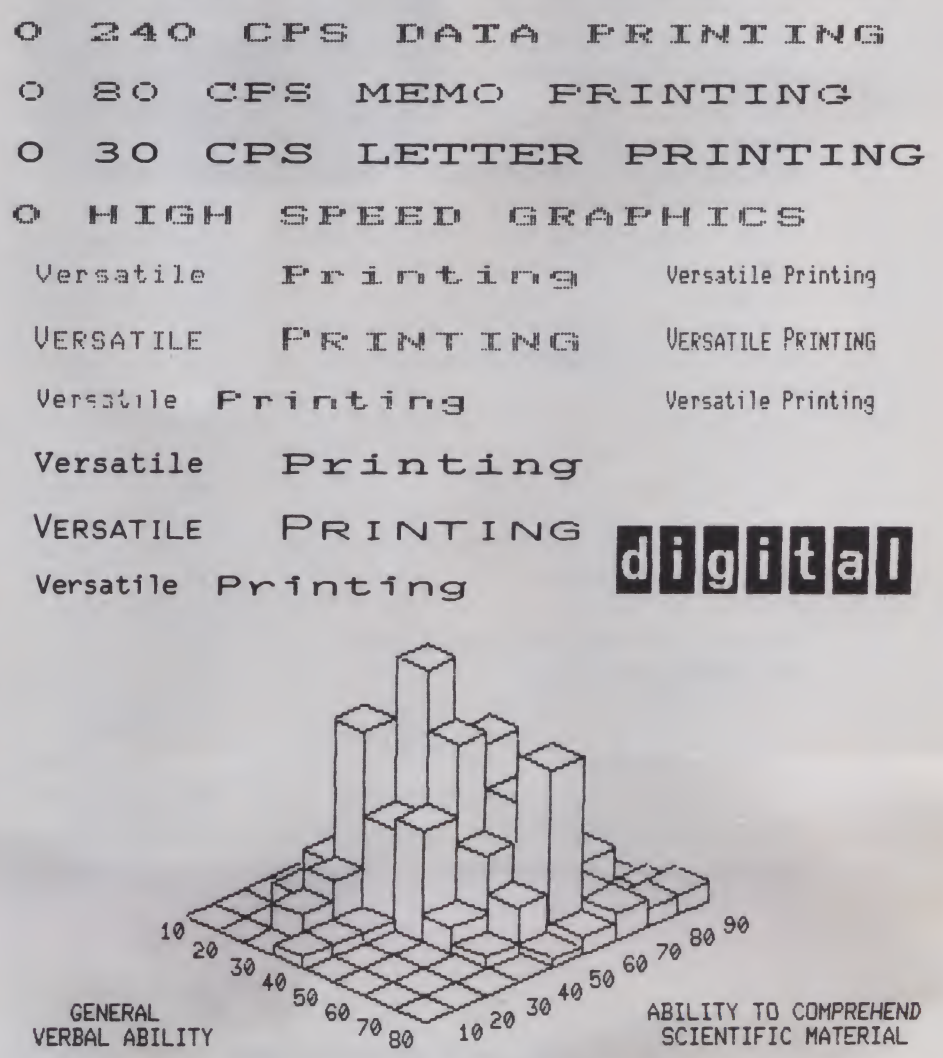

Figure 2. Print and graphics from Letterprinter 100.

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Photo 4. Letterprinter 100.

styles that can be printed under program control is shown in Figure 2.

The LQP02 is a daisywheel printer with a print speed of 32 characters per second. With a built-in 256 character buffer it has bidirectional printing capability and can operate at baud rates of up to 9600.

To produce bold characters, the LQP02 uses a technique called "shadow bolding" in which characters are struck twice as in normal bold print. But unlike normal bolding, the second strike is slightly offset from the first. This makes the bold print more visible.

Characters per inch are software selectable (10 or 12) as are lines per inch (2, 3, 4, 6 or 8). Margins, tabs and form length also can be software controlled.

Maximum print width is 13.5" on 15" paper. With an optional forms tractor, the LQP02 can handle fanfold paper.

CP/M 86/80

According to the DEC *Guide to Personal Computing*, "CP/M—Control Program for Microcomputers—is characterized as a single-task, diskette-based operating environment that is well-suited to low-cost personal computer hardware. CP/M was one of the first disk operating systems not designed for a particular computer."

"CP/M provides basic computer services. It is perhaps best known for its simple and reliable file system used with diskettes. It has been improved and rewritten over the years as faster, more reliable disk drives were introduced." New versions have also been written to take advantage of new 16-bit microprocessors.

The Guide continues, "The widespread acceptance of CP/M has resulted in numerous software vendors offering thousands of ready-to-run CP/M application programs." Very true. Every issue of *Microsystems*, a magazine devoted to CP/M, is filled with descriptions of new applications and utility software for the system.

But bear in mind, at the moment this vast library of CP/M packages cannot simply be purchased from a local computer store, popped into a Rainbow 100, and run. A large portion of the CP/M software is available only on 8" disks. Much that is on 5 1/4" disks has had subtle modifications added so that it runs on a specific system, a NorthStar for instance. As soon as Rainbow 100 systems start to be shipped in volume, there no doubt will be scores of software vendors converting existing CP/M software packages and writing new ones specifically for the Rainbow.

DEC has started a software program which will evaluate, rate and, in some cases market software from third-party vendors. The lowest category is "Digital-Tested." This means that DEC has checked all the details of the package and found it will run as specified in the documentation. It has no known "bugs" and meets DEC's criteria for installation, ease of use, and performance consistency.

The second category is "Digital-Serviced." This is the same as "Digital-Tested" but also meets the serviceability criteria set by the DEC Software Service organization. Service contracts will be offered on software in this category.

"Digital-Developed" is the seal applied to DEC's own software products, although in some cases these products have been developed by outside organizations. The following packages are in this third category.

Word Processing Program

Before describing the word processing program, it is important to "set the stage." Andy Knowles and Barry Folsom, Rainbow product manager, emphasized that the Rainbow WP package is aimed at managers and occasional users who need to prepare memos, letters, and reports. For heavier WP users, they strongly recommend the DECmate II system which runs DEC's time-tested WPS Word Processing System. That said, let's look at the *Select* WP package for the Rainbow 100.

Select Information Systems, Inc. of Kentfield, CA has been marketing a word processing system for CP/M, MP/M and CDOS systems for several years. It is a comprehensive system which requires at least two disk drives, an 80-character screen and 48K or more memory. For this review, we shall simply call it "*Select*."

Select is a menu-driven system. After loading, the main menu appears on the screen (see Figure 3). Page 6 of the manual emphasizes, "The best way to learn *Select* is to **put the manual down now!** Type "T" for Teach and take the *Select* tutorial."

That is exactly what I did. It took me about 90 minutes to work through the tutorial which combines a friendly tutorial style with plenty of hands-on practice. Each command is fully described and illustrated on the screen. An example is then presented. This is followed by a practice problem with prompting so it is nearly impossible to go wrong. Finally, a second practice problem is presented with no hints or prompting (except what would normally appear on the screen). At the end of each command, the program asks if you would like a review or if you wish to go on.

Text is created by entering Edit mode. From this mode, 21 commands can be invoked (see Figure 4). To create text, you simply select Insert and start typing. In Insert mode, only the backwards cursor key is operational; it is used for erasing. If you make a mistake, you may erase back to it and continue typing from that point. On the other hand, if you notice an error three or four lines earlier, it is generally best to finish the current sentence or paragraph, press Escape (to store your text in memory), and enter one of the correction modes.

Let's consider an example. In the paragraph above, I mistyped "correction" as "corecting." To correct this, I pressed ESC at the end of the paragraph. The message flashed on the screen:

"Justification taking place, please wait."

This process took about four seconds to justify the text and two seconds to rewrite the screen. I then positioned the cursor over the e, typed I (for insert), typed the missing letter r, and ESCAPE. Another

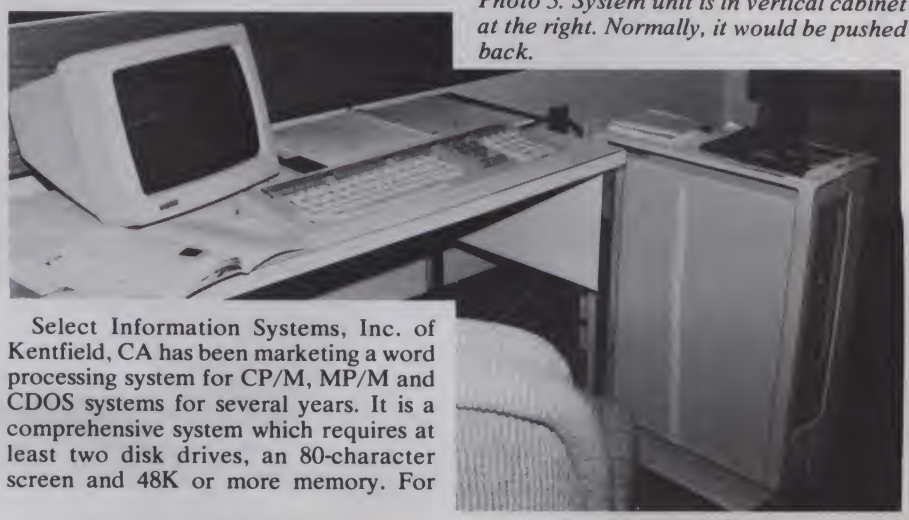

Photo 5. System unit is in vertical cabinet at the right. Normally, it would be pushed back.

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five-second delay to justify and rewrite the screen. I then moved the cursor over the n, typed X (for exchange), typed the correct letters (on), and ESCAPE. Since justification need not be done after an exchange operation, the software was immediately ready to proceed.

This process is, of course, quite different from that used by the memory mapped word processing systems available on most microcomputers. *Select* does not move letters, words and paragraphs around as changes are made. Rather, such movement is done only when the ESCAPE key is pressed. Personally, I found it awkward to get used to *Select* after years of using *Electric Pencil* and *Scripsit*. However, this article is testimony to my having learned it since it was written entirely in *Select* on a Rainbow 100.

Print formatting commands must be imbedded in the text. Note, I did not say "may be." On the other hand, most formatting commands are set using a menu (see Figure 5), which automatically inserts them at the beginning of the text when ESCAPE is pressed. Other formatting commands such as a short dash to begin or end underline or a caret to designate boldface must be inserted in the text at the appropriate point.

Select has all the expected features of a modern personal computer word processing package such as headers, footers, page numbering, merging blocks of text or entire documents, justification and the like. However, it has two important features rarely found in small systems: Teach and Spell.

As I mentioned earlier, I learned to use *Select* in about 90 minutes using the Teach tutorial. While this is valuable in getting started, it is especially useful to the infrequent user of the system. Even after using *Electric Pencil* for 5 1/2 years, if I haven't written anything for a week or two, I frequently find myself leafing through the manual to find a particular format command. With *Select*, I could merely "turn to" Teach and review the operation of a little used command to refresh my memory as to its operation. An even shorter form of Teach is "Help" which contains a short description and example of each command and can be called while creating or editing a document without destroying anything.

Spell is a part of the *Select* package which automatically proofreads a document against a dictionary of 9346 words on the *Select* disk along with any others you might wish to add. The system identifies words which it thinks might be in error, displays each one, and asks if you wish to correct it or ignore it (say a deliberate misspelling or a trade name which is similar to a real word). I did not use Spell extensively, so I do not feel that I should pass judgment on it either way. It *seems* useful.

After my document got quite long (10 plus pages), the system started to act a bit flaky. I have no way of knowing whether this was hardware or software. At the end of a line when a long word is being typed, the software moves the word to the beginning of the following line, for example the word "started" at the beginning of this paragraph was moved when I typed the letter "e." However, on the next line the letters were altered and it became "uvctvgf." This did not happen every time, perhaps one line in every 20 or 30. I noted that it tended to occur more frequently when I was typing quickly.

```
SELECT: Create Edit Delete View List Name Print Spell Teach Merg Help Quit Run

        Create - to CREATE a new document
        Edit   - to EDIT or change a document
        Delete - to DELETE a document
        View   - to get a scrolling VIEW of a document
        List   - to LIST all the documents in your directory
        Name   - to assign a new NAME to a document

        Print  - to PRINT a document
        Spell  - to check your SPELLING

        Teach  - to TEACH you to use SELECT
        Merge  - to MERGE a document with a mailing list
        Help   - to HELP explain the commands
        Quit   - to QUIT your SELECT work session

        Run    - to RUN a program outside SELECT
        Alter  - to place SELECT into program development mode
```

Figure 3. Main menu of Select offers 14 choices.

```
COMMAND LINE I:

>SELECT:  Insert Erase Pointer Goto Locate Replace Display Quit Next

COMMAND LINE II:

>SELECT: Spell Format Append Verify Xchng Tab Next Help

COMMAND LINE III:

>SELECT; Move Copy Zap Output Write Justify Next
```

Figure 4. Twenty-one commands can be invoked from Edit mode.

Multiplan Spreadsheet Package

Multiplan is a spreadsheet calculation program similar to *VisiCalc* or *SuperCalc*. Rather than describing the entire package, I will simply note some similarities

```
FORMAT> Enter command, then value, then (RET); (ESC) to exit

    Top Margin              6     Bottom Margin        8

    Left Margin            10     Right Margin        75

              Indent Margin        10

    Paper Length           66     Spacing of Lines     1

    Characters per inch           Vertical lines per inch
     [10 or 12]            10      [6 or 8]            6

              Number Pages         1

    Justify [Left or Center or Right or None]   L

    End current page [Yes]                      N

    Automatic Return      Yes     Display Status Line   Yes

    Mark Pointer          Yes     On-Screen Justification Yes
```

Figure 5. Print formatting commands are selected from a menu.

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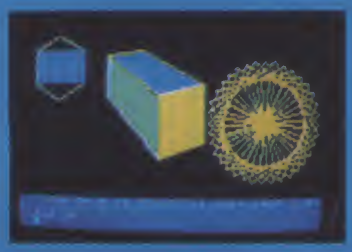

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and differences between *Multiplan* and *VisiCalc*.

Multiplan is produced by Microsoft Corp., Bellevue, WA and, on the Rainbow 100, offers a worksheet 255 rows long and 63 columns wide for words, numbers and formulas. The biggest difference between *Multiplan* and *VisiCalc* is the ability of one *Multiplan* worksheet to reference another. In other words, say one worksheet contains salary calculations consisting of employee names, regular and overtime hours, hourly rates and salaries, deductions, taxes, etc. A second worksheet may be a summary of department expenses. In this case, the second worksheet can reference just the final department summary salary expenses from the first without having to create an intermediate file or re-enter the data.

Another difference between *Multiplan* and *VisiCalc* is that *Multiplan* allows the creation of up to eight windows within the display area compared with two for *VisiCalc*. While this may sound four times as good, in three years of fairly heavy usage of *VisiCalc*, I have rarely used the two-window capability and can't imagine needing three or four windows, much less eight.

A nice feature of *Multiplan* is the message line at the bottom of the screen which displays comments on the progress of any command, and the percentage of remaining storage.

A not-so-nice difference is the convention in *Multiplan* of numbering both rows and columns. Thus in *VisiCalc*, a reference to Row 3 Column 2 is B3 whereas in *Multiplan* it becomes R3C2. Even worse is the handling of "relative" references. This is done automatically in *VisiCalc* as rows and columns are shifted. *Multiplan* requires the user to define a relative reference in advance. For example, to add Row 1, Column 1 to Row 1, Column 2 and put the result in Row 1, Column 3 so that it may later be shifted to make room for another row requires the following commands:

VisiCalc @SUM(A1+A2)

Multiplan V SUM(R[-2]C+R[-1]C)

VisiCalc: 11 keystrokes. *Multiplan*: 19 keystrokes. And the winner is . . .

I was also not impressed with the method of assigning labels in *Multiplan*. Typing any alphabetic character in *VisiCalc* automatically indicates a label whereas *Multiplan* requires that A (for alphabetic) be typed preceding a label.

Other differences are relatively minor. In most regards *Multiplan* behaves "as expected" and like *VisiCalc*, is an excellent tool for asking the all-important "what if?" questions of business planning and financial modeling.

Photo 6. Author puts Rainbow 100 to the test.

Microsoft includes two fat 192-page instruction manuals with *Multiplan*. Unfortunately, I can only describe the styles as "written by programmers for programmers." These will soon be available in "DEC colors," presumably written in a more user-friendly style. In addition, Bob Montemerlo mentioned the possibility of adding a tutorial Teach mode similar to that of *Select*. Nothing definite yet.

Basic, C, et al

Standard Microsoft Basic (Version 5.26) is being offered with the Rainbow 100. It is the 8086 version and runs under CP/M 86. It is loaded from disk and occupies 29K of RAM. Assuming sufficient memory is available, Basic can use up to 64K. However, even if the optional 256K option is installed, Basic can still use just 64K.

The Basic is excellent with password-protected files, dynamic string space allocation and up to 40-character variable names. Structured statements include:

WHILE/END
IF/THEN/ELSE
nested IF/THEN/ELSE

Machine language calls, CHAIN and COMMON (Fortran, here I come!) as well as Trace and error trapping are also included. Table 1 shows selected characteristics.

However, given the excellent graphics of the Rainbow 100 hardware, I found it curious that DEC did not contract with Microsoft to include any graphics functions. I also wonder why the following features, all implemented in Microsoft Basic on the IBM PC, were not implemented on the Rainbow 100:

Graphics and music commands
Function keys
Device Independent I/O
TIME$ and DATE$
Screen editor

A spokesman from Microsoft told me that an extended Basic with these features *might* be offered by Microsoft at some future date to run under MS-DOS. The Rainbow 100 is available with MS-DOS (Microsoft Disk Operating System) as an alternative to CP/M 86/80. At this point the main advantage to MS-DOS is that under it, industry standard disks can be read. Also, a few software packages are available for MS-DOS that are not available under CP/M.

Incidentally, at NCC people from DEC were bragging that their Basic didn't have that nasty divide by 0.10 bug in IBM PC Basic. Sorry, guys, yes it did. But it doesn't

Characteristic	Implementation
Name length	40 characters
Integer arithmetic	Yes
Multi-statement functions	No
Function recursion	Yes
Statement numbers	0 to 65535
Floating point precision	7 single 16 double
Exponent	±38
Nested IF	Yes
Link to machine language	Yes
Maximum array dimension	255
CHAIN and COMMON	Yes
Error trapping	Yes
Trace features	Yes

Table 1. Selected features of Rainbow 100 Basic (Microsoft version 5.26).

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anymore. The bug was in all Microsoft Basic implementations, and when they fixed one they fixed them all.

C, a structured language generally available under the Unix operating system, is also available on the Rainbow 100. I did not have an opportunity to use C, however, those familiar with the language will appreciate the full implementation (not Tiny C) on Rainbow.

Service

The personal computer market has grown up much more closely allied with the consumer electronics industry (hi-fi, video games, auto sound, TV, video, etc.) than with the traditional computer industry. After all, consider how many personal computers are sold in retail stores like hi-fi systems versus those sold by a salesman calling on a customer with field service and software support contracts as part of the deal.

DEC, is attempting to bridge this gap by offering a choice of five levels of service.

A friendly "Do Me First" Computer-Based Instruction course is available with all the personal computers and is standard on the two Professional models. This interactive course is designed to help users learn, use, and quickly become productive on a system.

For users with critical requirements, DEC offers an On-Site System Support Agreement—a total service package. This covers both hardware and the operating system. Part of this service is a toll-free "help line" that provides response to questions concerning installation, warranty, hardware, software, accessories and supplies.

A slightly lower level of service is Carry-In offered on both a contract (second level) and per-call basis (third level). All systems have a set of diagnostics built in which helps the user locate the source of any problems with diagnostic messages on the screen or, in the event of screen failure, with LEDs on the system board. Carry-In service offers quick repairs of user-diagnosed problems as well as a toll-free help line, engineering modifications, and updates.

A fourth level of service is Mail-In designed for those capable of doing their own system maintenance. Using the built-in diagnostics, you isolate the faulty part and mail (or bring) it in. After testing by the service center, a new or repaired replacement part is sent to you.

Finally, self-maintenance is available for those who wish to keep their own inventory of spare part kits.

In the past, DEC maintenance has had a reputation for being reasonably good as long as you signed the contract or paid the price (not cheap!). However, Andy Knowles emphasized that service on the personal computers is an area in which DEC is determined to be competitive with everyone in price, quality, and flexibility.

Pricing and Delivery

When I initially priced out the systems shown in the pricing chart, my reaction

System Configurations and Pricing

1. Basic Programming System

PC100	System unit, 64K RAM, dual disk drive	$2675
PC1K1-AA	Keyboard unit-USA	245
VR291A	Monitor 12", B&W	325
QV012-A3	CP/M 86/80 operating system	250
QA066-C3	MBasic	250
TOTAL		$3745

2. Spreadsheet/Word Processing System

PC100	System unit, 64K RAM, dual disk drive	$2675
PC1K1-AA	Keyboard unit-USA	245
VR201A	Monitor 12" B&W	325
QV012-A3	CP/M 86/80 operating system	250
QA061-C3	*Select* word processing package	595
QA063-C3	*Multiplan* spreadsheet package	275
PCXXF-BA	Floor stand	99
LA50-RA	100 cps printer	950
TOTAL		$5414

3. Advanced Programming and Graphics System

PC100	System unit, 64K RAM, dual disk drive	$2675
PC1K1-AA	Keyboard unit-USA	245
VR241-A	Color monitor	1325
QV012-A3	CP/M 86/80 operating system	250
PC 1XX-AA	64K RAM memory expansion	495
PC 1XX-BA	Graphics display option	845
QA066-C3	MBasic	250
LA100	Letterprinter 100	3000
TOTAL		$9085

4. Problem Solving, Spreadsheet, Communications System

PC100	System unit, 64K RAM, dual disk drive	$2675
PC1K1-AA	Keyboard unit-USA	245
PC1XX-AB	192K RAM memory expansion	1095
PC1XX-BB	External capabilties option	500
RCD50-BA	Winchester 5M subsystem	3700
PCXXF-BA	Floor stand	99
QV012-A3	CP/M 86/80 operating system	250
QA063-C3	*Multiplan* spreadsheet package	275
QA068-C3	C language	500
QV015-A3	CX/DX/VT102 communications package	200
LA100	Lineprinter 100	3000
TOTAL		$12539

was "GULP!" They *seemed* much more expensive than the competition.

But let's consider three system configurations for spreadsheet calculations. All three include CPU, 128K memory, keyboard, B&W display, one disk drive (two on Rainbow 100), DOS and spreadsheet software.

	System	Printer	Total
DEC Rainbow 100	4265	$950	$5215
Apple III	4690	525	5215
IBM PC	3735	810	4745

Viewed in this light, the DEC Rainbow 100 is right on target. Considering the included dual processors and dual floppy drive, it may even be a bargain.

I think the reason for my initial "gulp" is mainly because the lowest entry price system ($2745) is $1000 to $2000 above other entry systems. Also, the software packages are rather pricey—$250 for DOS, $250 for Basic, $275 for a spreadsheet, $595 for word processing and $395 each for payroll, accounts receivable, accounts payable, inventory, and general ledger.

On the other hand, the Rainbow 100, while hardly pushing the state of the art, has those dual processors, dual disk drives, excellent keyboard and, perhaps best of all, the Digital name.

Some years ago, the IBM name was thought to be worth 20 to 25% of the price of a computer. In other words a competitor would have to be *more* than 20-25% lower than IBM to be in the running. In the miniworld, the same is true with DEC today although the differential is probably more like 15%. However, as a result of the enormous mini customer base and excellent reputation of DEC, it is likely that the DEC personal computers will find a ready market.

Will the DEC entries harm Apple, IBM or Tandy? I doubt it. If anything, the biggest effect will be to further legitimatize the personal computer itself as another blue chip name is added to the field.

Delivery on most units of the Rainbow 100 system is being quoted as Q4 '82. I wish I could say this meant October but if the experience of other manufacturers is any guide, December 31, 1982 is probably more like it.

Conclusion

Perhaps the most significant feature of the Rainbow 100 is the incorporation of both an 8-bit Z80 and 16-bit 8088 processor along with a "soft-sense" operating system, CP/M 86/80, to automatically run applications software on the correct processor.

Selecting CP/M as an operating system instead of the more Unix-like Oasis or a proprietary DEC system is also significant since it immediately makes available a large number of practically off-the-shelf applications software packages. Having a 16-bit processor built in insures that this will continue to be true.

Hardware-wise, the keyboard is outstanding. I also like the idea of two double density floppy disks on one drive spindle. The immediately available optional 5 megabyte Winchester disk means that storage should be ample for virtually any application.

I find the *Select* Word Processing package and *Multiplan* spreadsheet package curious choices. However, given the comparatively high prices of these packages, I would guess it will not be long before other software vendors jump in and widen the range of choices in these two most important areas.

Bottom line: the Rainbow 100 should have a long successful life. □

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TK!Solver from Software Arts

David H. Ahl

When Dan Bricklin and Bob Frankston, creators of *VisiCalc*, decided to go it alone, it created quite a stir in the business press. *Business Week*, *Fortune* and other magazines all did stories describing and speculating about their fledgling company, Software Arts.

Buoyed by the phenomenal success of *VisiCalc*, Software Arts is off to a flying start. During a visit to their cramped offices on the 12th floor of one of the few high rise buildings in Cambridge, MA, one of the first things that Dan showed me were the architectural plans for a 20,000 sq. ft. facility in Newton, MA. Bob Frankston was quick to point out that their "new" 60-year old building had a dock along the Charles and could be reached by canoe from Cambridge in about 40 minutes.

I remarked that when Creative moved into its 25,000 sq. ft. facility about 18 months ago, I had thought I might sublease about 10,000 sq. ft. However, within three months of moving in, it became apparent that if we had 1,000 sq. ft. to sublease it would be a lot. Dan mentioned that when Software Arts first contracted to renovate the space they had planned to lease out the first floor (about 10,000 sq. ft.) but now, three months later, they are wondering if the building has enough space for their own rapidly-expanding operation.

An impressive operation it is! A Prime computer with a zillion megabytes of storage serves as the main software development machine. Scores of microcomputers are wired into this system. While the communication links are direct today the new facility will be totally wired for Ethernet to allow micro-to-micro communication as well as micro-to-mainframe.

I have rarely seen so many microcomputers both in quantity and variety in one location as I saw at Software Arts. Major projects include development of an advanced version of *VisiCalc* (to be marketed through VisiCorp), conversion of *VisiCalc* to every imaginable computer and, of course, the TK!Solver development work.

What is TK!Solver?

TK!Solver (TK for Tool Kit) was designed to provide professionals in engineering, business and other fields a personal computing tool with which to solve problems involving mathematical calculations and analysis. As with *VisiCalc*, it is not necessary to know a programming language to use *TK!Solver*. The user simply types in one or more equations and the known variables. *TK!Solver* then solves for the missing variables using either a direct solve technique or, if necessary, an iterative technique.

I journeyed to Cambridge to beat on *TK!Solver* mercilessly for nine non-stop hours. I asked the folks there to leave me alone with the software and documentation; after all, I wanted to approach it as a typical user. Diane Curtis, product manager for *TK!Solver*, kindly lent me her IBM Personal Computer and a corner of her cramped office for the day while she spent time with some customers and consultants.

My occasional questions were quickly

Dan Bricklin shows me a fine point of iterative problem solving with TK! Solver.

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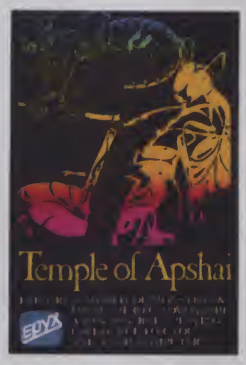

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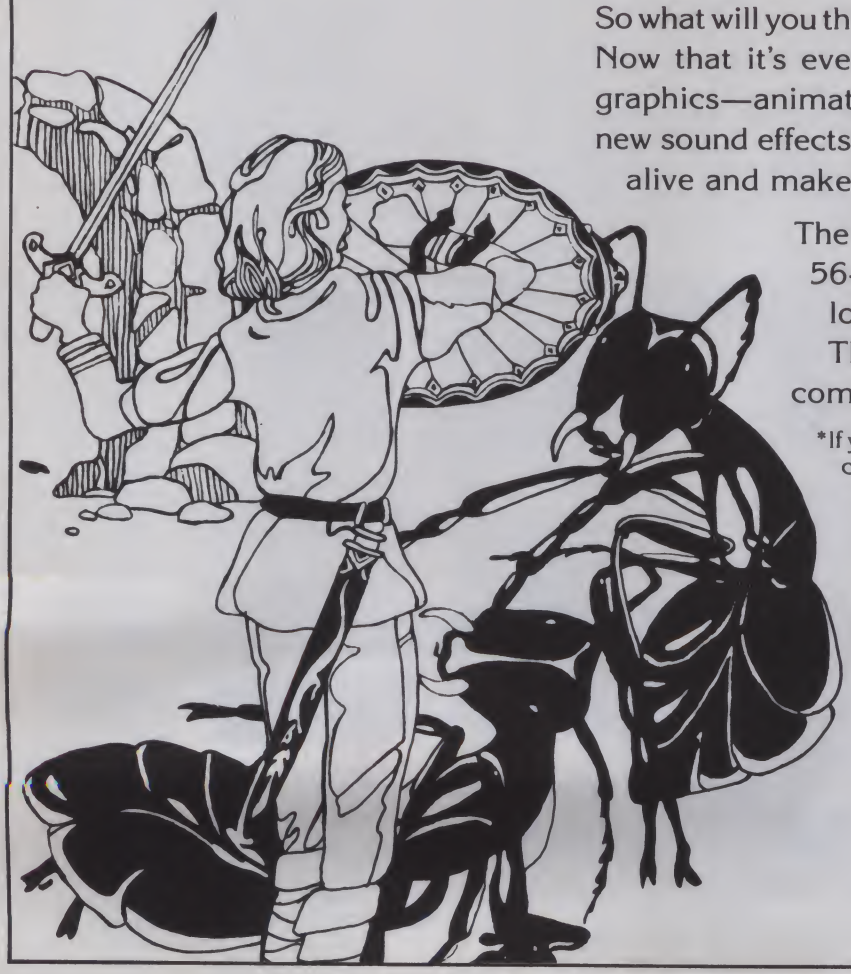

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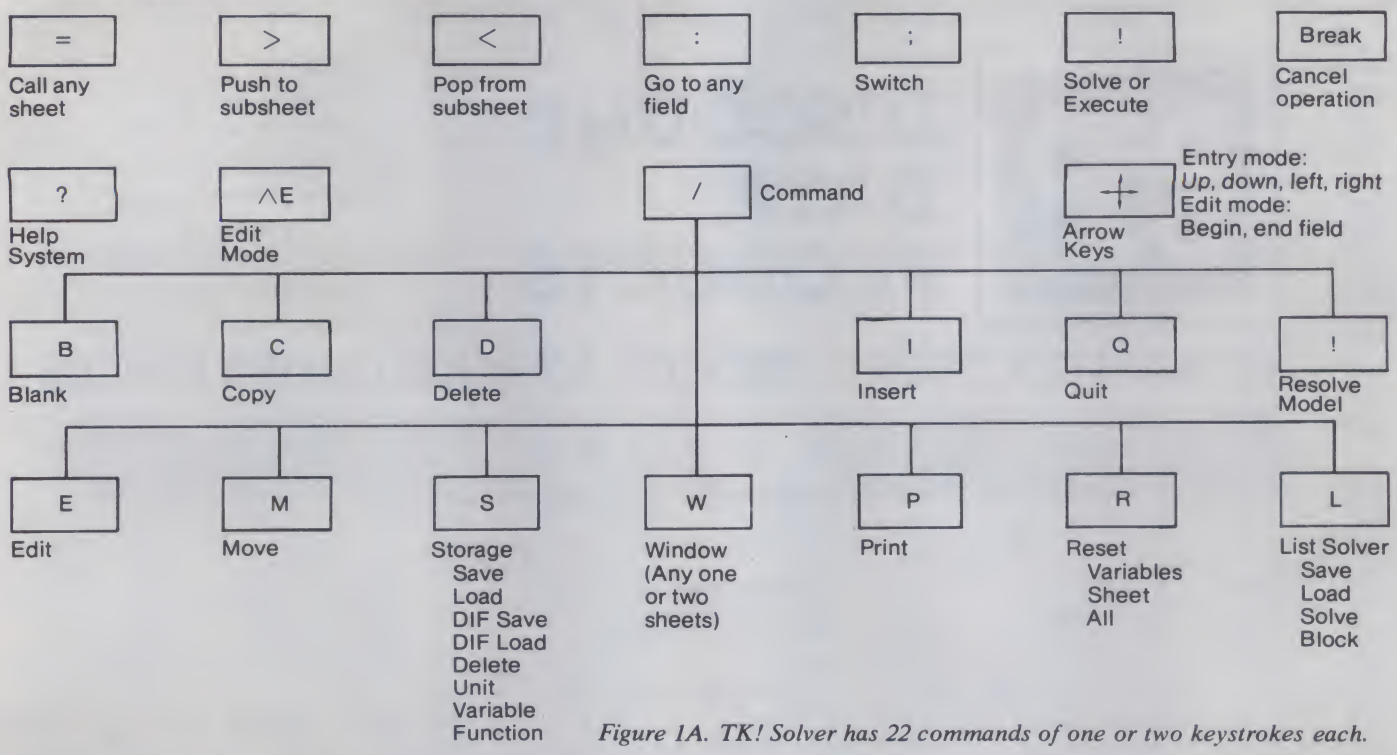

Figure 1A. TK! Solver has 22 commands of one or two keystrokes each.

answered by the genial folks at Software Arts but, for the most part, the account that follows represents the independent exploration of *TK!Solver* by a more-or-less typical user.

Getting Started

Upon loading the system, a two-line Message Area appears at the top of the screen. The first line, the Status Line, displays information about the status of the program. The second line, the Prompt/Error Line, displays messages.

The position indicator at the far left of the Status Line tells you the position of the cursor with a row number and letter (representing the label of the column). To the right of it is the contents of that field (data, label, etc.). This may seem redundant, but it is very useful because it shows the entire contents even though it may be more than can be displayed in the field, e.g., the status area may show a 20-character label or an 11-digit number even though the field may display only six or eight characters.

On the far right of the Status Line is a Memory Indicator which shows the amount of remaining memory in your work area. A handy feature is the message "Low" which is displayed when memory capacity drops below 1000 bytes. Essentially this cries out, "Save your file on disk before you lose it!"

The last character on the Status Line is a Solution Indicator. When you enter equations, an exclamation point appears here indicating that they are unsolved. It disappears upon solving a model but reappears if any changes are made.

The Prompt/Error line is used for prompts which require a response, for messages telling the status of the program, and for error messages.

Help, Help!

The Help Facility is always available. It reminds you of features and commands you have learned but may not remember. However, as the instruction booklet points out, "It is not intended as a substitute for the Instruction and Reference Manuals."

When the first *TK!Solver* sheets are displayed, the Prompt/Error line displays the message:

For Help, type ?

This prompt disappears when you type any key. If you type "?", the Prompt/Error line displays the message:

Help: ? or topic:

The cue remains on the Prompt/Error line so that you can type and enter either a question mark or a topic you want to be explained.

A Menu of Commands

TK!Solver has a menu of 22 commands (see Figure 1A). These commands are used to enter formulae and data, manipulate data and units, solve equations, and move among the sheets, windows and operations. Sound complicated? It's really not. (The 11 sheets are shown in Figure 1B—more about them later.)

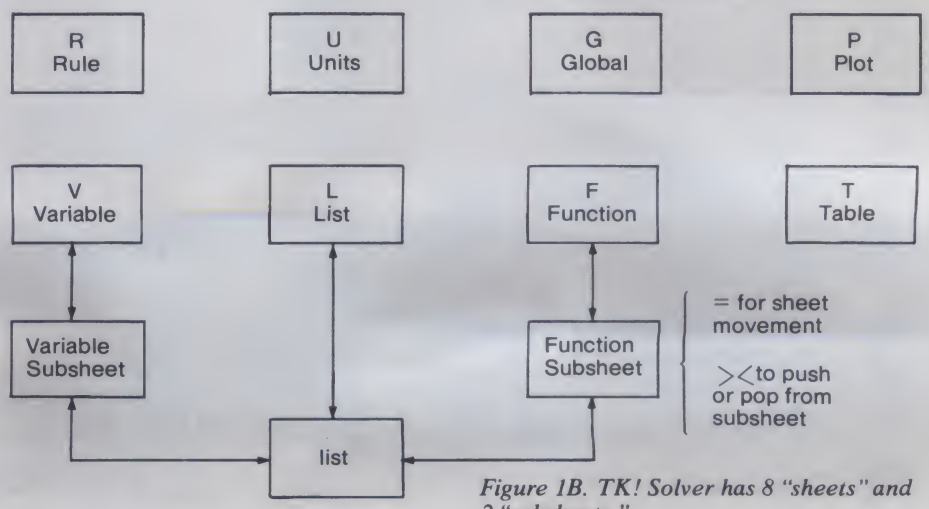

Figure 1B. TK! Solver has 8 "sheets" and 3 "subsheets."

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CIRCLE 165 ON READER SERVICE CARD

TK! Solver continued...

Diane Curtis, TK! Solver Product Manager at Software Arts, Inc.

I brought with me some data on municipal bonds. Basically, I was interested in using the system to compare bonds and do some portfolio calculations. Initially, I called up the "Rule Sheet" and entered two formulae:

A = C*F
Y = A/P

in which:

A = Annual Income
Y = Current Yield
C = Coupon
F = Face Value
P = Purchase Price

I then entered information about a Camden, NJ bond:

P = 13103 (dollars)
C = 5.3 (interest rate)
F = 25000 (purchase price)

Upon pressing ! to solve for the unknown variables, I got the following:

A = 132500 (Annual income)
Y = 10.112188 (Current yield)

Obviously I was not going to get $132500 annual income for the next 13 years on a bond that cost $13103. The problem, of course, was that I expressed percent as 5.3 rather than .053. Well, I want to express percent as 5.3 or 10.1 and not the decimal equalivalent so I turned to the unit portion of *TK!Solver*. When the menu showed From and To, I entered the following for C and Y:

From	Pct
To	Dpct
Multiply by	.01

I recalculated but got the same result. Since this didn't help, I was tempted to change the formulas. However the Variable Status Sheet contained the clue to the dilemma. I simply wanted to display a different unit than my calculation unit. So I entered the following:

Display Unit	pct
Calculation Unit	dpct

Now, when I pressed ! to recalculate the table, I found that:

A (annual income) = $1325
Y (current yield) = $10.112188

Much more reasonable! But frankly I didn't like the 10.112188; good grief, who needs that many significant digits? However, *TK!Solver*, unlike *VisiCalc*, does not have a formatting capability. The solution was to enter another rule (formula) that stated:

yld = (int (10000 * y))/10000

Of course, I had to enter the unit table and define display (pct) and calculation (dpct) units for "yield" as I had for C and Y.

At this point the screen appeared as shown in Figure 2. As I entered the rules, the program automatically entered the variables in the same order as they appeared in the equations.

This wasn't too tidy, so using the Move command (/M), I moved the rows around. Also, using Delete (/D), I deleted Y since Yld showed the same thing. When I say deleted that does not mean it is gone—after all, it is a vital variable in the equations—but it is no longer displayed in the variable table. To reassure myself that it still existed, I called up the variable sheet for Y and found it intact (see Figure 3).

```
VARIABLE: y
Status:
First Guess:
Associated List:
Input Value:
Output Value:          10.1121880485
Display Unit:          pct
Calculation Unit:      dpct
Comment:
```

Figure 3. Variable subsheet for y.

I also added comments and filled out the unit field (with dollar signs). When all this was done, the screen appeared as in Figure 4.

creative computing

SOFTWARE PROFILE

Name: TK! Solver
Type: Model building and solving tool
System: Many computers
Format: Disk
Language: Machine language
Summary: Easy to learn and use; wide variety of applications
Price: $299 for TK! Solver; $50 to $100 for applications packs
Manufacturer:
Software Arts, Inc.
675 Massachusetts Ave.
Cambridge, MA 02139

```
(5i) Input: 13103                                                    64 /

==================== VARIABLE SHEET ==========================================
St Input      Name     Output     Unit      Comment
-- -----      ----     ------     ----      -------
              a        1325
   5.3        c                   pct
   25000      f
              y        10.112188  pct
   13103      p

              yld      10.11      pct

==================== RULE SHEET ==============================================
S Rule
- ----
  a=c*f
  y=a/p
  yld=(int(10000*y))/10000
```

Figure 2. Variable and Rule sheets after entering municipal bond formulae and data.

```
(1i) Input: 11.2                                                     64 /!

==================== VARIABLE SHEET ==========================================
St Input      Name     Output     Unit      Comment
-- -----      ----     ------     ----      -------
   11.2       c                   pct       Coupon Yield
   10000      f                   $         Face value of bond
   10375      p                   $         Offering price

              yld      10.79      pct       Current yield
              a        1120       $         Annual interest

==================== RULE SHEET ==============================================
S Rule
- ----
  a=c*f
  y=a/p
  yld=(int(10000*y))/10000
```

Figure 4. Same as Figure 2 with variables reordered and comments added.

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MING'S challenge

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- You sit, fingering the *kill* button, in your small spaceship at the bottom of the screen.
- Suddenly Ming directs Deathships straight at your fragile craft.
- Next the Claymen, at a signal from Ming, hurtle bombs at you.
- You can neutralize Ming's Deathships by shooting them and placing them in suspended animation.
- Cyclops drop bombs on you and freeze the Deathships, making them disappear into hyperspace (making you lose points).
- If you do not place Deathships into suspended animation they will vanish into the Black Hole and you will lose points.
- Greater perils and varying challenges await you and only the truly TOP game players will survive MING'S CHALLENGE.

As a player, you enjoy the option of altering the parameters endlessly...changing speed of the game, number of enemies, width and depth of the Black Hole. Also, if you are the first to survive MING'S CHALLENGE, you will receive either the next 10 games produced by MICROFUN, free of charge, or any single business product presently available from MICROLAB.

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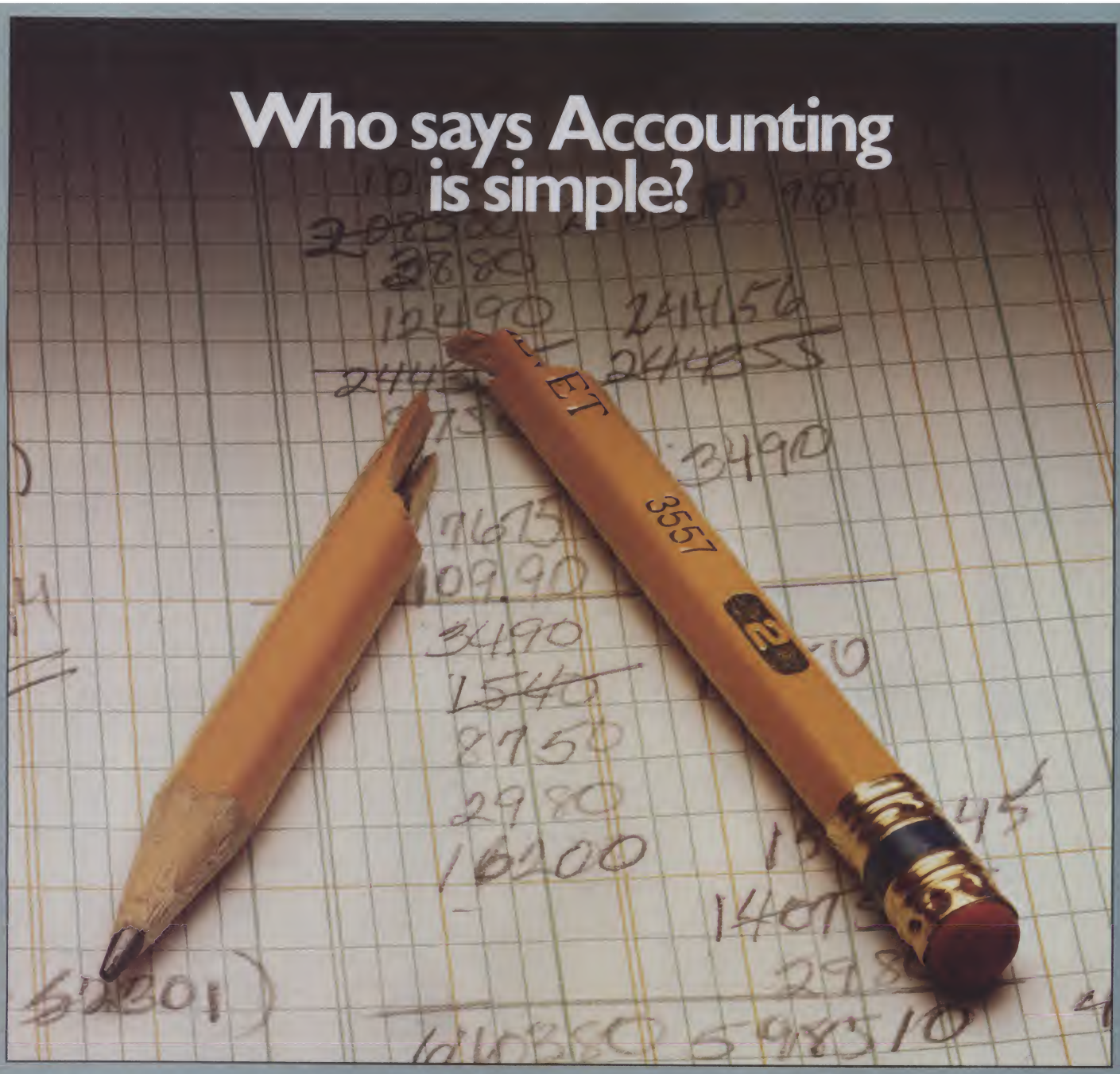
CIRCLE 186 ON READER SERVICE CARD



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CIRCLE 125 ON READER SERVICE CARD

TK! Solver continued...

Now I could use the model to compare some municipal bonds, at least in a simple sense. I decided to look for maximum current income from a list of bonds offered by a municipal bond dealer. Here is the data from the first four bonds. The last two columns are calculated with my *TK!Solver* model.

Bond	*Coupon*	*Face*	*Price*	*Yield*	*Annual Income*
Mt. Kisco 7/98	10.875	10000	9500	11.45	$1088
Erie County 3/99	5.00	10000	5250	9.52	500
Mass Housing 10/87	2.00	10000	6275	3.18	200
Waterford, CT 6/90	11.20	10000	10375	10.79	1120

Naturally, there is more to comparing bonds than that since capital gains must be considered for the last three bonds. In fact, the total yield to maturity includes the capital gain plus the annual yield from the coupon, but at least I had a good start with *TK!Solver* giving me the yield and annual income from each.

Lists of Data

Instead of immediately going into the more complicated yield-to-maturity calculation, I decided to consider a portfolio summary. In this case, the list was longer, representing a portfolio of bonds accumulated over several years. I simulated this with data for 16 bonds taken from Lebenthal offering lists. Instead of entering data individually, I wanted to enter a list of data, have all the calculations performed *en masse*, and see a list of output values.

To do this, I entered the status area on the Variable Sheet and entered L (for List). To enter a list, you move the cursor over the list name on the Variable Sheet, press the right caret and the blank List appears. (Alternatively, a List can be entered from the List Sheet.) Typing values in order automatically fills in the list.

I then wanted the program to automatically solve my equations for all 16 sets of data I had entered in the lists. This was done by simply entering the list solver (/L) and pressing solve (!). You must have some dummy data in the input variables at this point or *TK!Solver* will just sit there not knowing which are input and which are output variables.

During the solving process, you can display each set of variables in turn on the screen or, for maximum speed, you can turn off the display from the Global Sheet (=G).

When the solving process was done, I called the List Sheet (=L) and, lo and behold, my output variables were now filled with values (see Figure 5).

I now had a fictitious half million dollar municipal bond portfolio in the computer. First I wanted some summary information about it. Here I had a choice: I could enter more rules or use *TK!Solver* as a calculator. I chose the latter approach.

To do this, you go to any value (or numeric) field on any sheet and simply type in the calculation you wish to perform including variables, functions, lists, etc. First, I wanted the sum of the bond face values so I went to an empty field and typed:

SUM ('F)

The apostrophe indicates that all values of the list are to be summarized. In a split second 550,000 appeared. Ah ha, the face value of the portfolio was $550,000 not one-half million. The sum of the purchase price was, $459,899.

Okay, that was simple. Now for a tough one. I wanted the weighted coupon yield based on the face value and the weighted current yield based on the purchase price. To get this, I would have to multiply each yield by each price, take the sum of these products and divide by the sum of the price. But *TK!Solver* has a solution in the form of a function called DOT. DOT returns the dot product of two specified lists. Each element in the first list is multiplied by the corresponding element in the second list and the products are summed. Hence, my calculation for weighted coupon yield was simply:

DOT ('C, 'F) / SUM ('F)

I found the weighted coupon yield to be 8.69% and the weighted current yield 10.3%. Gee, I wish I had this portfolio.

Plots and Graphs

I next hypothesized that there might be some sort of relationship between current yield, yield to maturity and coupon yield. What better way to look at these than with a plot or graph? So I called the Plot Sheet (=P) and filled in "C" (coupon yield) for the X variable and "Y" (current yield) and "YTM" (yield to maturity) for Y variables. I also specified plot characters Y and M (for yield to maturity). The resulting plot is shown in Figure 6. Municipal bond investors will not be surprised

```
(7c) Comment: Yield to maturity                                          60 /'

==================== LIST SHEET ==================================================
Name        Elements  Unit      Comment
----        --------  ----      -------
y
c           16        pct       Coupon yield
f           16        $         Face value of bond
p           16        $         Offering price
yld         16        pct       Current yield
a           16        $         Annual Interest
ytm         16        pct       Yield to maturity

==================== RULE SHEET ==================================================
S Rule
- ----
  a=c*f
  y=a/p
  yld=(int(10000*y))/10000
```

Figure 5. List sheet shows variables and elements (values) in each list.

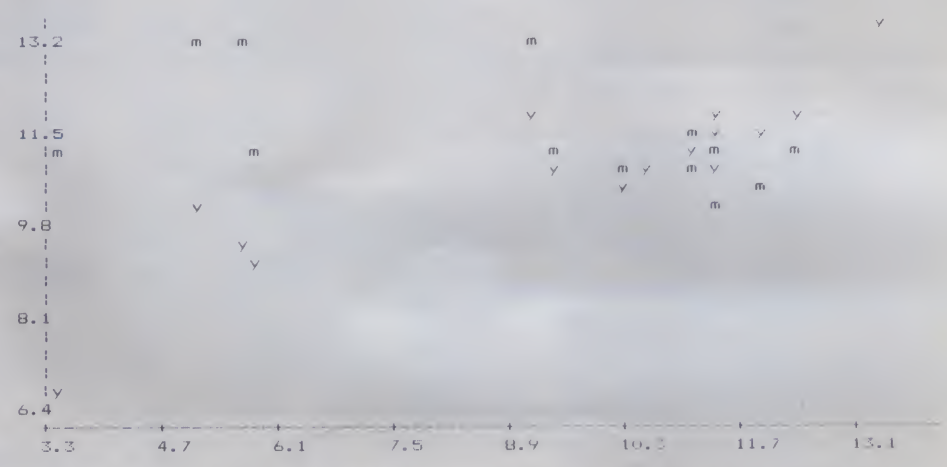


Figure 6. Plot of current yield (y) and yield to maturity (m) against coupon yield. TK! Solver offers many plot options.

```
(v) Variable Insert ON: Yes                                          60 /!

==================== GLOBAL SHEET ==============================================
Variable Insert ON:          Yes

Intermediate Redisplay ON:   Yes
Automatic Iteration ON:      Yes
Comparison Tolerance:        .00000001
Problem Scale:               .099999999999
Maximum Iteration Count:     10

Page Breaks ON:              Yes
Page Numbers ON:             Yes
Form Length:                 16
Printed Page Length:         16
Printed Page Width:          30
Indentation:                 0
Printer Device or Filename:  PRN
Printer Setup String:
Line End (CR/LF or CR):      CR/LF
```

Figure 7. The Global Sheet shows parameters that apply to the entire model, printer and plotter settings, etc.

to see that current yield is directly related to coupon yield, and yield to maturity is inversely related.

From the Global Sheet it is possible to set the output page size. By reducing it, you can automatically scale a graph down if you want to jam it into a smaller space. The Global Sheet is also the place from which printer names and conventions are specified. (See Figure 7.)

Plotting is not limited to the scatter charts produced by *TK!Solver*. Data, variables, units, etc. may be saved on a disk using the DIF (Data Interchange Format) and used in other programs such as *VisiCalc* and *VisiPlot*. Conversely, data from *VisiCalc* may be read into *TK!Solver* from a DIF disk.

Iterative Problem Solving

Not all problems can be solved directly by simply substituting values in formulae. Let's consider a simple problem of a retail business. Say a video game cartridge has a manufacturer suggested list price of $29.95 and the cost is $21.00. We enter the formulae for margin and markup:

ma = (s-c)/s
mu = (s-c)/c

in which:

ma = margin (%)
mu = markup (%)
s = selling price
c = cost

Entering the data above and solving indicates a 29.9% margin and a 42.6% markup (see Figure 8).

But you know from experience that any margin less than 35% is cutting things too close. To make a 35% margin, what should the selling price be? I put 35 in margin as an input and blanked out (/B) the $29.95 selling price. I pressed ! to solve and nothing happened. No longer was output defined by a direct equation.

To solve, I entered a guess (it could be anything, but I put in 30) and, after five iterations, *TK!Solver* indicated that 32.307692 was the selling price required to make a 35% markup (see Figure 9). Now you know why most retailers price video game cartridges at $31.95.

Present Values

The present value of future cash flows are extremely important to all kinds of businesses. Let's say that you can automate a portion of your assembly line for $10,000. Your volume is growing, so you expect this automation to be increasingly important for the next three years, but to drop in Year 4 as product obsolescence is reached. Hence, you expect your cash flow to be as follows:

cf0	-10000	(Cash flow in Year 0 or cost now = $10,000)
cf1	2000	(Cash generated in Year 1 = $2,000)
cf2	3000	
cf3	5000	
cf4	2000	

You put in the following rule (or formula):

pv=npv(rate, cf0,cf1,cf2,cf3,cf4)

If the cash flow values were entered in a list as described above, the rule could also be expressed as:

pv= npv(rate, 'cf)

in which:

pv = present value
npv = a *TK!Solver* function for calculating net present value
cfn = cash flow in year N

Upon entering this formula, the data above, and 0 for present value, I tried to solve for the rate of return. No go. So I simply put in 1 as my guess for a rate and watched *TK!Solver* iterate to a solution of 7.4%. Pretty poor! I could do better in the money market.

So I put in 20% as my desired rate and blanked out the cash flow in Year 4. *TK!Solver* said I needed $6960 cash flow to make it. Impossible.

I put back the original cash flows and blanked out the initial investment (cf0) and solved. In this case, it told me I couldn't invest more than $7610 to get a 20% return.

Using this, I could try any number of different scenarios, perhaps entering my data in lists and plotting the various results.

```
(3i) Input:                                                          68 /

==================== VARIABLE SHEET ============================================
St Input      Name     Output      Unit       Comment
-- -----      ----     ------      ----       -------
   29.95      s                               Selling Price
   21         c                               Cost
              ma       29.883139  pct         Margin
              mu       42.619048  pct         Markup


==================== RULE SHEET ================================================
S Rule
- ----
  ma=(s-c)/s
  mu=(s-c)/c
```

Figure 8. Variable and Rule Sheets for a markup and margins model. Model here solved for margin and markup given selling price and cost.

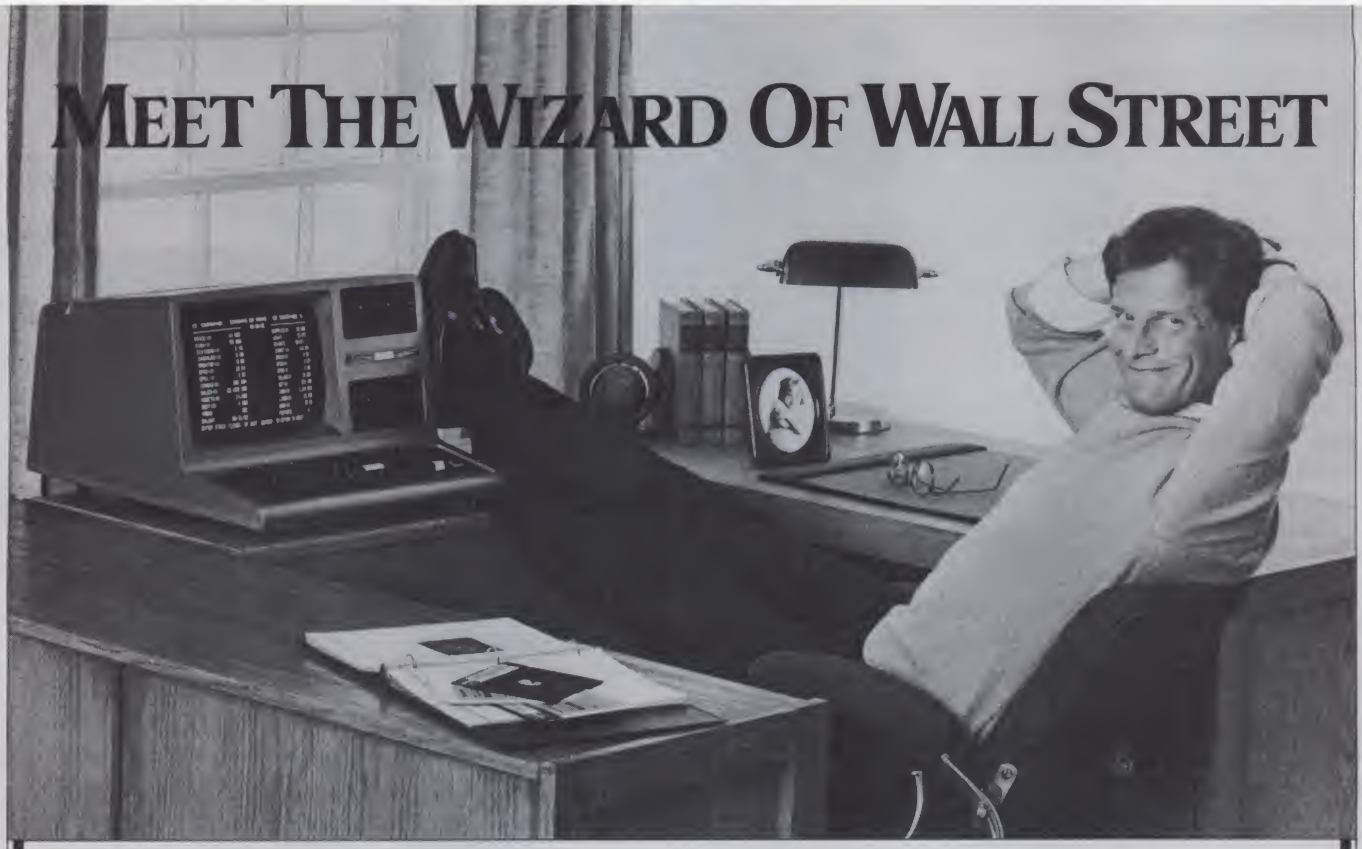
```
(1s) Status:                                                         68 /

==================== VARIABLE SHEET ============================================
St Input      Name     Output      Unit       Comment
-- -----      ----     ------      ----       -------
              s        32.307692               Selling Price
   21         c                               Cost
   35         ma                  pct         Margin
              mu       53.846154  pct         Markup


==================== RULE SHEET ================================================
S Rule
- ----
  ma=(s-c)/s
  mu=(s-c)/c
```

Figure 9. Same model as Figure 8 except it was used to solve for selling price (iteratively) given cost and desired margin.

MEET THE WIZARD OF WALL STREET



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TK! Solver continued...

Other Functions

A total of 34 functions are built into *TK!Solver*. They range from the expected trig, log and square root functions to advanced math and business functions. For example, inverse hyperbolic tangent and log base 10 functions are included. As mentioned earlier, dot product, list sum, and net present value are available, as are functions to return the minimum or maximum value in a list, count the elements in a list, or even apply a user function to a domain of values.

Other Applications

Software Arts will be introducing a series of applications packages consisting of a disk with rules, variables and units tables along with a detailed manual for each. Similar to the HP41C packages, these will give instructions for running the package as is but also will show the user how to change it to meet his own requirements.

I tried an early version of the mortgage package and found that a $95,000 house with a 20% down payment and 30-year 18.5% mortgage would cost me $1176 per month. However, if I could scrape together $1400 per month I could reduce the term of the mortgage to 10 years(!) or purchase a $115,000 house (see Figure 10).

Other packages are being prepared for education (a neat population model, among others), civil engineering, mechanical engineering, HVAC, convertible bonds, institutional portfolio management and many more.

```
(6o) Output: 1176.4378389                                                  68 /

==================== VARIABLE SHEET ==========================================
St Input      Name    Output     Unit       Comment
-- -----      ----    ------     ----       -------
   95000      H                  dollars    House price
   19000      d                  dollars    Down payment
              p       76000      dollars    Mortgage
   30         n                  years      Term
   18.500000  i                  interest   Interest rate
              A       1176.4378  dollars    Monthly payment
              T       423517.62  dollars    Total of payments

==================== RULE SHEET ==============================================
S Rule
- ----

  " Simple Home Mortgage Model

  H=p+d
  A=p*(i/(1-(1+i)^-n))        "Monthly payment formula
  T=A*n
```

```
(1i) Input:                                                                67 /

==================== VARIABLE SHEET ==========================================
St Input      Name    Output     Unit       Comment
-- -----      ----    ------     ----       -------
              H       115442.52  dollars    House price
   25000      d                  dollars    Down payment
              p       90442.518  dollars    Mortgage
   30         n                  years      Term
   18.500000  i                  interest   Interest rate
   1400       A                  dollars    Monthly payment
              T       504000     dollars    Total of payments

==================== RULE SHEET ==============================================
S Rule
- ----

  " Simple Home Mortgage Model

  H=p+d
  A=p*(i/(1-(1+i)^-n))        "Monthly payment formula
  T=A*n
```

Figure 10. Screen photo shows mortage model used to calculate number and amount of monthly payments. Below the same model calculates that a $1400 monthly payment would allow buying a house costing $115,442.

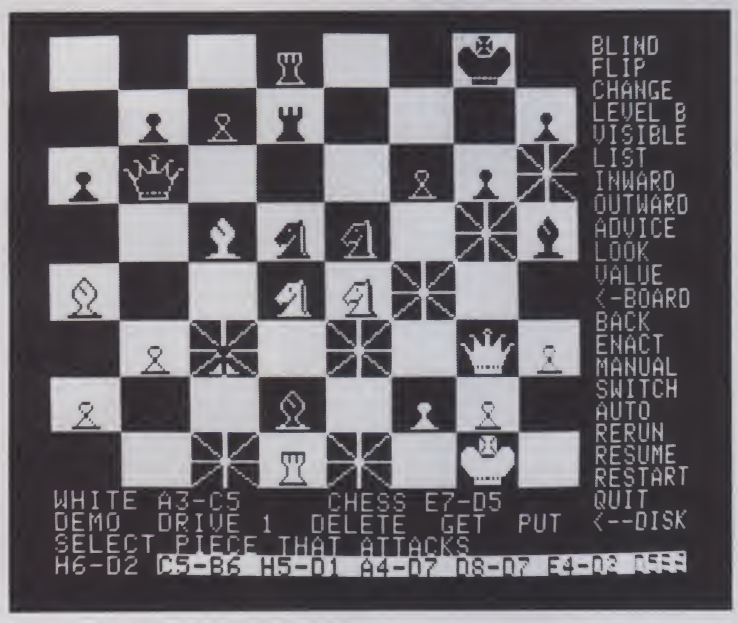
The Ultimate Solution?

Ever since I attended Software Arts' initial press conference introducing *TK!Solver*, people have asked me, "Is it another *VisiCalc*?"

Frankly, I don't know. It seems that many of the users at which *TK!Solver* is being aimed are already computer literate and are probably using timesharing (with packaged software) or a microcomputer (with self-written programs in Basic). However, both of these groups probably would be more than enthusiastic about a user-friendly tool like *TK!Solver*. It may not sell as many computers as *VisiCalc* has, but it certainly will win as many friends. □

Software Arts TK Solver

Explore the Frontiers of Intelligence



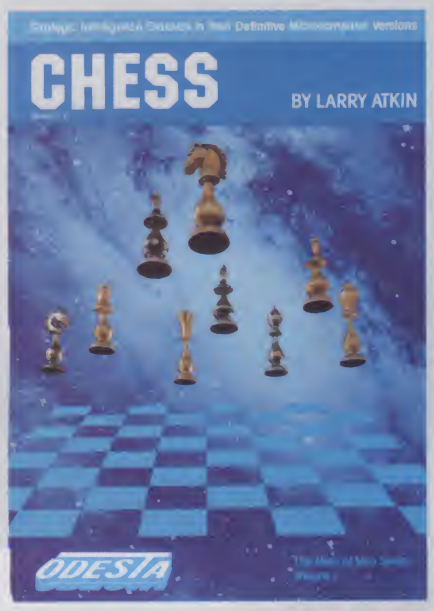
- ◀ Variations of blind-fold play—camouflaged or invisible pieces
- ◀ Invert board to play black on bottom
- ◀ Change pieces on board during game, or set up position
- ◀ Change between 15 levels of play, plus postal and mate-finder modes
- ◀ Show move that **Chess** is thinking about
- ◀ List played moves for each side
- ◀ Lines of force in: attacks and defenses on a square
- ◀ Lines of force out: squares attacked and defended
- ◀ **Chess** suggests a move
- ◀ Show moves **Chess** thinks you will make, and its responses
- ◀ Evaluation of a position
- ◀ Return to board or switch to command menu
- ◀ Take back a move (repeatable)
- ◀ Play move suggested by look-ahead search
- ◀ **Chess** plays neither side
- ◀ Switch sides
- ◀ **Chess** plays against itself—one level against another
- ◀ Replay through most advanced position
- ◀ Skip to most advanced position
- ◀ Start new game
- ◀ Leave program
- ◀ Save, get, and delete games to and from disk

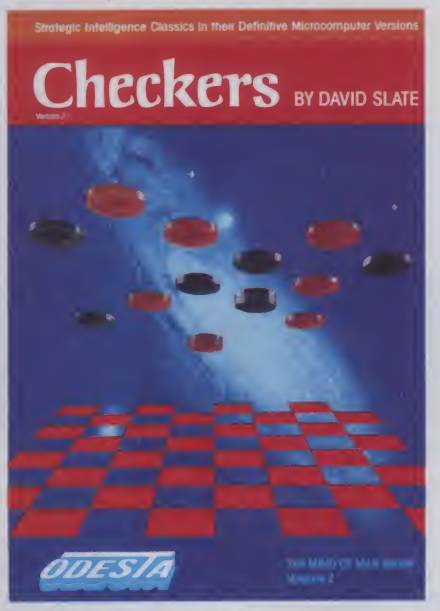
All features self-documented; all choices cursor-controlled
Screen shows "outward" and "look" features being used

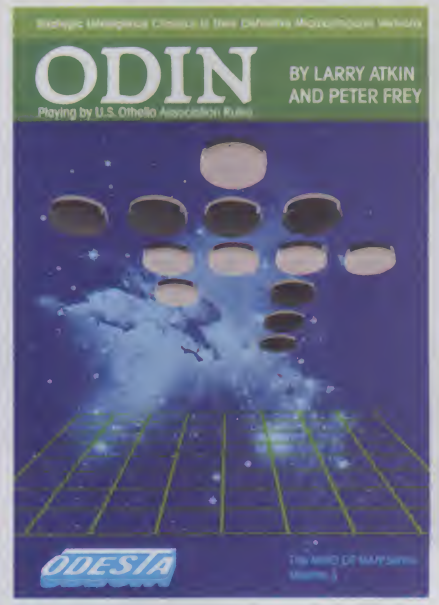
THE PEOPLE BEHIND THE PROGRAMS:

Larry Atkin & David Slate: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

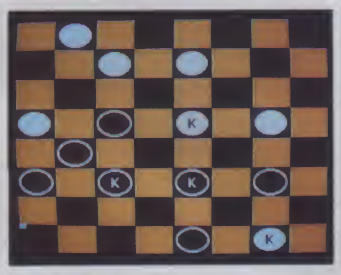
Peter Frey: Northwestern University professor
Editor: **Chess Skill in Man and Machine**
One of U.S. Othello Assoc.'s top-ranked players



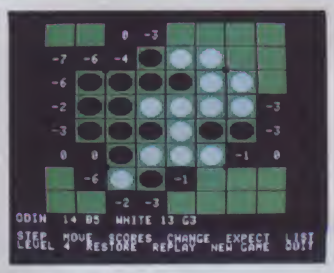




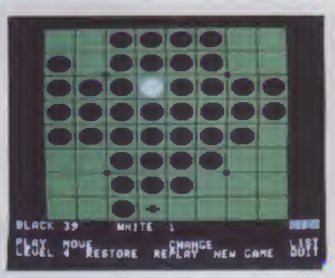
Checkers' features



Black to move and win
(From Checkers documentation)



"Scores" feature in Odin



A clue to the secret of Odin:
Black is destined to lose.

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For **Apple II, Apple II Plus 48K** disk systems, and **Atari 48K** disk systems. Odin is also available for **TRS-80 Model 1 & 3 32K** disk systems.

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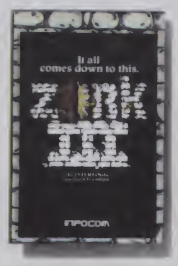

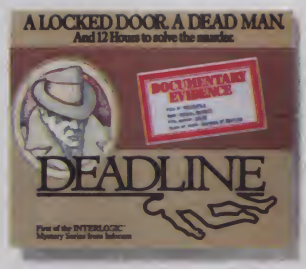

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creative computing software evaluation

Computation Made Easy

Brian J. Murphy

International Software Marketing may be onto something big in *MatheMagic*, a program which turns your computer into a powerful calculator with many possible applications in technical, scientific and academic settings.

The Apple II version we saw, written in Applesoft Basic by Joe Luciano, loads from one disk drive, although the user manual points out that a data disk is required and that the program is more easily run when two drives are available.

MatheMagic is not a VisiCalc style spreadsheet program but a tool for turning the Apple into a programmable calculator. When you think about it, microcomputers are called upon to do many chores, such as compiling information, storing and retrieving data, sorting files, and executing commands to a variety of peripheral devices, but they are seldom used to *compute*—to do mathematical chores. With *MatheMagic*, a new era begins.

In simple terms, what *MatheMagic* does is to create files of formulas which the user can store on separate data disks for retrieval as needed. *MatheMagic* then solves mathematical problems using these retrieved formulas. It sounds simple enough, but there is a world of possible applications for *MatheMagic*.

Let's take a closer look at the program. As the documentation says, you are better off with two disk drives because you work with a program disk and one or more data disks which are used for storing the formulas you create and save. The data disks are initialized in the usual way.

Once you have your disk initialized, relax; the program manual and the program itself give you appropriate cues when it is time to switch disks in your single drive. Users with two drives will find that the switching is automatic.

All command options are displayed on screen menus. The first menu offers the housekeeping options. You can decide which slots are to be used for the drives, how many drives are to be used, which user will operate the program, whether to have a floating decimal, and whether to print hard copy.

The next task is to create formulas. Before we discuss that, however, let's digress and discuss applications. After all, the formulas you write depend on your own personal or business needs. Stop here. If, by now, you can't think of any computations you would like *MatheMagic* to do for you, or if the ones you think of are as easily done on a $12 calculator, you probably don't need *MatheMagic*.

If on the other hand, you do the same calculations over and over again, or if you frequently solve complex equations, *MatheMagic* can be a godsend. Certainly architectural engineers, electronics experts, statisticians, and other professionals in technical fields will find the program of great potential value. Theoretical scientists will also find abundant applications for *MatheMagic*, although the program is not equipped to do calculus.

Educators and parents may also find *MatheMagic* quite useful. Teachers will find that it is a painless way to get students to think mathematically as they create formulas, test them, and store them in their own files. Parents may also find the program useful in turning the Apple II into a learning tool that can re-ignite the interest of a child who has been "turned off" to math in school.

Now we must ask, how difficult is it to create and save files of formulas with *MatheMagic*? The answer is that it is not too difficult, but to use the program effectively takes a little practice. The major functions of *MatheMagic* are run from a "Formula Menu" from which the user creates the formulas, edits them, saves or loads them through the disk system, and performs the calculations.

There is a small glossary of symbols and abbreviated commands which stand for *MatheMagic* functions. These include the standard Apple II symbols for the basic operations, such as / for division, and * for multiplication.

For more complex functions there are three-letter codes which seem fairly log-

Brian J. Murphy, 133 Post Road, Fairfield, CT 06430.

creative computing
SOFTWARE PROFILE

Name: MatheMagic

Type: Calculation program

System: 48K Apple II with Applesoft, NEC PC-8000, IBM PC, CP/M based systems, and at least one disk drive

Format: Disk

Language: Applesoft or Microsoft Basic

Summary: Calculator for scientific, academic, and technical applications.

Price: $89.99

Manufacturer:
International Software Marketing
Suite 421, University Building
120 E. Washington St.
Syracuse, NY 13202

ically derived. A few of them are LOG for common log, TAN for tangent, SQR for square root, and DEC for the decimal value of a hex number. Variables can be signified in your formulas by any combination of letters up to 30 characters long.

For example, in a suggested mileage calculation formula, *MatheMagic* recommends that you subtract a variable called MILESTHEN from a variable called MILESNOW and divide the result by GAS for gallons. The formula you type in looks like this:

(MILESNOW-MILESTHEN) / GAL

The result, once you give the CALCULATE command is your miles per gallon.

If it occurs to you that you don't have to express the formula more algebraically (X = (a - b)c) you have grasped one of the major advantages of using *MatheMagic*. When you call up your MPG formula it might take a little time to figure out which of the expressions in X = (a - b)c is supposed to be gallons, which old miles and so forth. Using the *MatheMagic* system there is no such confusion.

MatheMagic can also handle arrays of formulas and functions. For example, if you have a formula for the Pythagorean Theorem under the name @PYTH, and you want to find a number that is five times the result of the formula, you input 5*@PYTH and the computer calls up the

formula, asks for the values of the variables, and instantly gives you a result multiplied by five.

Similarly, you can combine formulas for more sophisticated calculations. This is one of the more appealing facets of *MatheMagic*. It works like this: suppose, for example, you have a formula which determines the number of units you can manufacture in a given span of time. You can create this formula with *MatheMagic* and save it under the name UNIT.

Suppose now you want to write a program which calculates unit costs. You can do so, saving it under the title COST. Now, if you want to figure out how many units you can make and the total cost involved, you do so by commanding @UNIT * @COST.

If you have another formula to calculate shipping costs, you can command @UNIT * @COST + @SHIP. If you want to consider three production runs, you command 3 * (@UNIT * @COST + SHIP). If you plan to use these formulas frequently, you save them under one title, such as @PROD. Every time you call up @PROD, you get @UNIT * @COST + @SHIP.

The potential for combining and recombining your most frequently used formulas is almost unlimited. You can create formula libraries swiftly, and handle the variables easily, thanks to the logical system of naming them with words. When you are through you can get a full-size sheet of hard copy from your serial or parallel printer, instead of cramped figures from a calculator tape which must be copied onto a larger format.

Improvements to *MatheMagic* are currently in the works. The most important of these are adaptations so that the program will work even more efficiently with hard disk retrieval systems. The version we evaluated was designed for a 48K Apple II. *MatheMagic* is also available for the IBM Personal Computer and CP/M systems. Versions for Radio Shack and Atari computers are said to be in the works. □

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The story of Herrera's success began with his son's sight problems. Young Steve Herrera had been born with severe cataracts in both eyes and, naturally, his father was concerned. Herrera reasoned that the boy's learning abilities could be seriously affected by growing up in a world he could not see.

Having just purchased an ATARI 800 Home Computer, it occured to Herrera that this could be the perfect tool for testing Steve's vision. So he wrote a program simply displaying the letter "E" in various sizes.

Success! It turned out that 2-year-old Steve could see even the smaller "E's" without special lenses. Herrera was first relieved, and then intrigued when he discovered that not only could his son see the "E's," but he would happily play with the computer-generated letters for hours. So Herrera added a picture of an elephant to go with the "E," and then more letters and pictures. Thus, "My First Alphabet" was born, a unique teaching program for children two-years and older consisting of 36 high resolution pictures of letters and numbers.

Herrera submitted the program to the ATARI Program Exchange, where it became an instant best-seller. ATARI was so impressed with the outstanding design, suitability and graphic appeal of "My First Alphabet," that the program is being incorporated into the ATARI line of software.

In addition to his grand prize winnings of $25,000 in cash and an ATARI STAR trophy, Herrera also automatically receives royalties from sales of his program through the ATARI Program Exchange.

But Fernando Herrera wasn't the only software "star" that ATARI discovered. Three other ATARI STARS were awarded at the ASAP awards ceremony for software submitted to the ATARI Program Exchange and

judged by ATARI to be particularly unique and outstanding.

Ron and Lynn Marcuse of Freehold, New Jersey, teamed up to write three winning entries in the Business and Professional category for home computers: "Data Management System," "The Diskette Librarian" and "The Weekly Planner."

Sheldon Leeman of Oak Park, Michigan, captured an ATARI STAR for his exceptionally well-engineered "INSTEDIT" character set editor.

Greg Christensen of Anaheim, California, became our youngest ATARI STAR winner at the age of 17. Christensen designed the clever "Caverns of Mars" game program, which also will be incorporated into the ATARI product line. Greg designed the program in 1½ months after owning his ATARI Home Computer for less than a year.

Every three months, ATARI awards ATARI STARS to the writers of software programs submitted to the ATARI Software Acquisition Program and judged first, second and third place in the following categories: Consumer (including entertainment, personal interest and development); Education; Business and Professional programs for the home (personal finance and record keeping); and System Software.

Quarterly prizes consist of selected ATARI products worth up to $3,000, as well as an ATARI STAR, plus royalties from program sales through the ATARI Program Exchange. The annual grand prize is the coveted ATARI STAR trophy and $25,000 in cash.

To be eligible, your software idea must be accepted by the ATARI Software Acquisition Program. Your program can have a broad application or serve a very specific purpose.

After submittal, consultation from ATARI is available if you need personal assistance with sound, graphics, or other technical aspects of your program.

To make your job easier, ATARI provides some 20 software development tools through the ATARI Program Exchange. A list and description of the various system software is published quarterly in the ATARI Program Exchange Catalog. These tools enable you to utilize all the ATARI resources and software, including the six ATARI programming languages.

Fernando Herrera had a great idea that made him a star. ATARI would like to give you the same opportunity.

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MatheMagic is available on: Apple II, IBM PC, CP/M and NEC PC 8000. Coming soon on TRS-80 Models I and III. GRAPHMAGIC is available on: Apple II and II+. Coming soon on IBM PC and NEC PC 8000. PRISM is available on: Apple II, Atari 400/800 Disk and Atari 400/800 Tape.

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IBM PC is a registered trademark of International Business Machines Corp.
CP/M is a registered trademark of Digital Research, Inc.
NEC PC 8000 is a registered trademark of Nippon Electronics Co.
Atari is a trademark of Atari, Inc. a Division of Warner Communications.

See MatheMagic, GRAPHMAGIC and PRISM at your favorite software dealer's or computer store. If they are not available, ask your dealer to contact us. You may also write or call us directly for complete information on all ISM products at:

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International Software Marketing
Suite 421, University Building
120 E. Washington Street
Syracuse, New York 13202
(315) 474-3400

683 Armadale Road
Feltham, Middlesex TW14-OLW
England
01-751-5791

CIRCLE 192 ON READER SERVICE CARD

Charts and Graphs from an Apple Computer

David H. Ahl

PFS:Graph is a software package for making line, bar and pie charts with an Apple II computer. The minimum system configuration is a 48K Apple II, one disk drive (two are preferable) and, according to the manual, an optional printer or plotter. For reasons discussed below, I felt the printer (or plotter) should not be listed as optional but rather as mandatory.

A functional block diagram of the *PFS:Graph* system is shown in Figure 1.

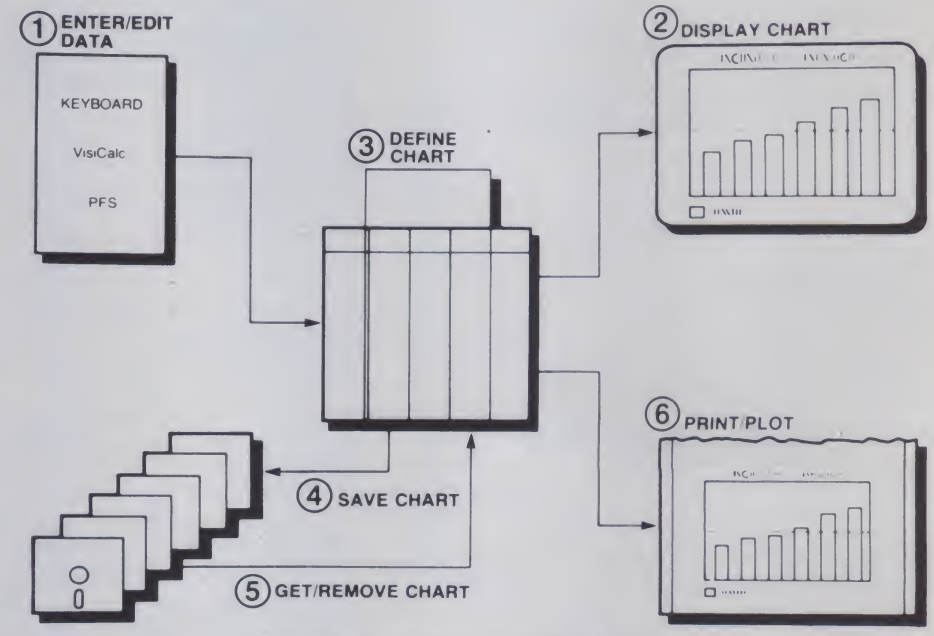

Figure 1. Block diagram of PFS: Graph.

Six Basic Functions

In the Enter/Edit data section, you can either enter data directly from the keyboard or retrieve data from a *VisiCalc* DIF file or PFS file. X axis data may be in one of three formats: numeric, identifier (labels), or date (month, day, year, quarter, etc.). Y axis data is always numeric.

Function 2 displays a chart or graph.

Function 3, Define Chart, changes the way *PFS:Graph* displays your chart and lets you add explanatory information to it. You can display your graph as a bar, line or pie graph. You can stack individual graphs on top of one another or show them comparatively, side by side.

Functions 4 and 5 are used to save charts on to disk and to retrieve them again.

Finally, using Function 6, Print/Plot, you can print your chart with a printer or plotter.

PFS:Graph is a menu-driven system. It always comes up with the main graph menu displayed. From this menu, any one of the six functions illustrated in Figure 1 may be selected. To give you some experience playing with the system before making your own graphs, a disk, which contains a wide variety of graphs and charts, is included. The introductory section of the tutorial manual is devoted to getting operational with the system and familiarizing yourself with the functions using the sample charts.

The balance of the manual is divided into six chapters, each of which describes in detail one of the six functions. The manual also includes four appendices which list and explain the error messages, provide a quick reference summary of the whole system, and provide information on using various printers and plotters.

Entering and Editing Data

Upon selecting Get/Edit Data on the main menu, a second menu is displayed which asks whether you wish to enter or

creative computing
SOFTWARE PROFILE

Name: PFS: Graph
Type: Charting and graphing package
Authors: Sebessi Chin and Stephen Hill
System: 48K Apple, disk drive, printer
Format: Disk
Summary: Bar, line and pie charts for up to four variables
Price: $125
Manufacturer:
Software Publishing Corp.
1901 Landings Dr.
Mountain View, CA 94043

edit data from the keyboard, get a *VisiCalc* file, or get a PFS file. If data are to be entered from the keyboard, the screen is divided into two columns, one labeled "X data" and the other labeled "Y data." The first thing you must do is tell *PFS: Graph* what kind of X data are going to be entered: identifier, numeric, or date.

An identifier is simply a collection of characters that identifies something, such as a department name, product name, or product number. These names may be up to fifteen characters long.

Numeric data may be integer or decimal numbers ranging from 10^{-30} or 10^{30}. They may be entered as "standard" numbers or in scientific notation, for example, 1E6 or 1E-5.

Dates can consist of up to three groups of digits that are separated by nonnumeric characters. Some examples of acceptable dates are:

12/10/81	3 10 80	2:9:82
12/81	3 80	2:82
12	1980	82

Date format may specify days, months, quarters, years or any legitimate combination of more than one variable such as YM for months of more than one year. The first graph I put in charted data from April 1981 to March 1982. I used the month format and entered the data in the order that I expected it to be plotted. However, because I had not specified different years, *PFS:Graph* assumed I was entering data out of order, and obligingly reordered it for me, which, unfortunately, was not at all what I wanted. This was easily corrected by changing to the combined YM(year month) format.

You can enter up to 36 pairs of X and Y values (only 16 if X is an identifier). If you make a mistake while you are entering data, the cursor control keys may be used to move the cursor to the incorrect value, which may be typed over to make the correction. Thus, the system is somewhat similar to a memory mapped word processing system. This is in contrast to *VisiCalc* or *VisiPlot* which allow you to jump from one value to another using the arrow keys. In *PFS:Graph* only the forward arrow key jumps to the next value. If you wish to jump back, you must use cursor control keys which move only one space at a time.

When all the data for a graph have been entered, you press CONTROL-C to *continue*. Indeed, *PFS:Graph* uses CONTROL-C in place of RETURN throughout to indicate that data are being entered to the computer. We understand the reason for this: it is all too easy to press RETURN to enter data and then suddenly realize that you weren't really ready to do so. CONTROL-C requires much more deliberation. On the other hand, after a while, having the two key-

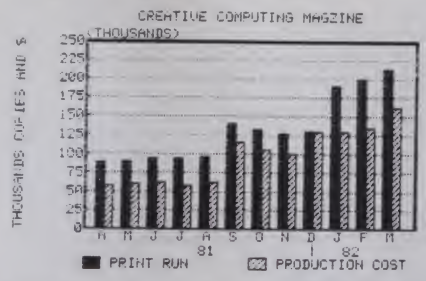

Figure 2. A maximum of 36 bars can be displayed or plotted. This figure shows 24.

strokes required to enter practically anything became rather annoying.

As soon as you have entered your data, you may go back to the main menu and ask to see it displayed. You need specify no display parameters, formats, or labels. *PFS:Graph* takes care of everything automatically, at least in a rough way. You may want to make your graph prettier before printing it out, but at least you can see what it looks like as you go along. We found this a big advantage compared to *VisiPlot* which requires several minutes between the data entry function and the graphing function.

If you have much data in *VisiCalc* files you probably want to use the direct entry capability rather than retyping these data. The *VisiCalc* file must be stored in the DIF format. Also, I found it worthwhile to select just that portion of the *VisiCalc* file that I wanted to graph and make a new file containing that data. This avoids the problem of selecting data from a much larger *VisiCalc* file which, in *PFS:Graph*, is a somewhat cumbersome operation.

Let me emphasize that you must know the format of the *VisiCalc* files before trying to read them into *PFS:Graph*. The *PFS:Graph* program will not read a file and then let you examine it for those elements that you wish to plot. Rather, you must specify at the time of reading the data the number of the row (or column) that will provide the X data and the same for the Y data. You must also know the format of the X data. If your *VisiCalc* files are anything like mine in which labels are occasionally mixed in with numeric data, be warned that *PFS: Graph* will balk at these inconsistencies and will not give you what you want.

PFS:Graph also has the ability to read data from a PFS file without any special preparation. Depending on the situation, you can read data from all forms in the file or from selected forms. Again, you must be able to specify completely what is coming in, as you will not be able to examine it during the data transfer operation.

One rather nasty problem I had was trying to get rid of data for an existing graph when I started to enter data for a new one. On page 1-5 of the manual it states that "if you want to change the X data format, you must clear the chart and start again." Unfortunately, not until page 3-13, does the manual tell how to clear out the old data. Once I learned I had to enter a CONTROL-R from the Define Chart Menu, I was okay. However, I felt this should have been mentioned much earlier in the manual to save unnecessary gnashing of teeth and leafing through pages.

The Way You Want It

The Define Chart function is used to change the way *PFS:Graph* displays your chart, and to add explanatory information to it. Using Define Chart, you can display most data in any of three formats (bar, line, or pie chart). You can "stack" the individual graphs on top of each other, adjust the Y axis to a different scale, and specify that the data in one or more of the graphs be displayed cumulatively. You can provide legends to identify data from each graph and titles for the chart

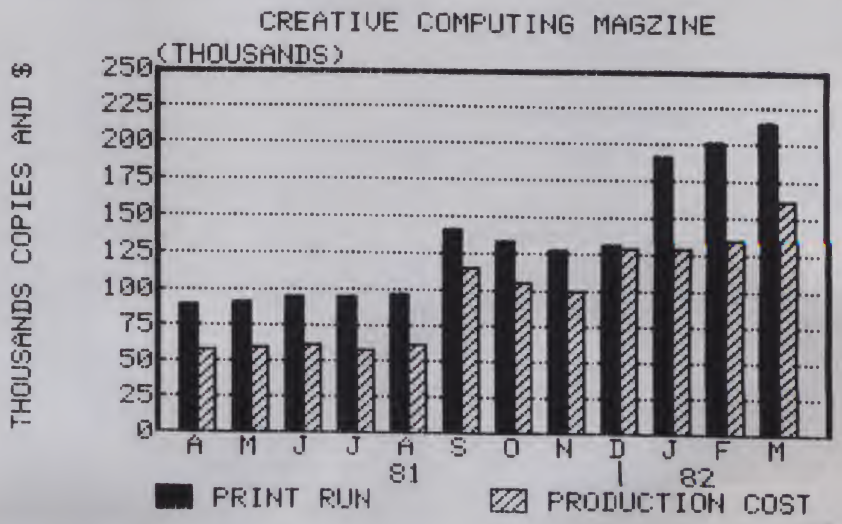

Figure 3. Same as Figure 2, but printed in expanded format (originally 8-1/2 x 11).

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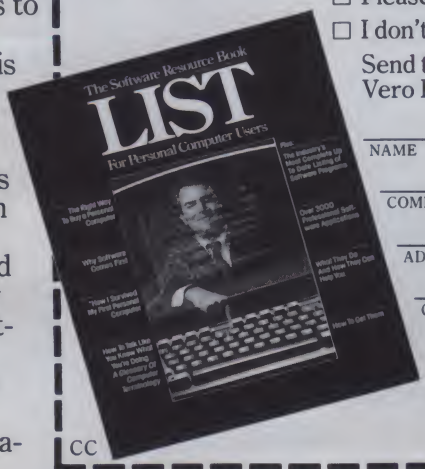

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and axes. Finally, you can control the horizontal grid line and display the chart in color (if you have a color monitor).

While this sounds quite comprehensive, it is at this point that various limitations rear their ugly heads. The chart, X axis, and Y axis titles can be up to 26 characters long. Thus, in the charts labeled "Creative Computing Magazine," magazine must be spelled "magzine." Why not 40 characters as in *VisiPlot*?

In bar charts, up to four sets of data may be displayed side by side. However, because of screen and printer resolution limitations, if four sets of data are displayed, only nine X axis data points may be used. In other words, a maximum of 36 bars may be displayed in the X direction. Even so, it is a bit cramped. See Figures 2 and 3 which display 24 bars side by side.

Up to four data points may be "stacked" in a bar (Figure 4 shows three stacked values).

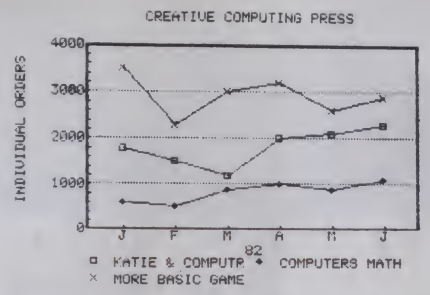

Figure 5. Line chart shows monthly sales of three books.

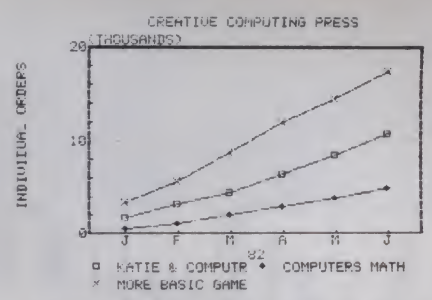

Figure 6. Using the same data as Figure 5 but plotted cumulatively.

is the ability to graph cumulative data. When this feature is selected, each point on the graph represents the total, or cumulative, Y value up to that point. Figures 5 and 6 illustrate this capability.

Pie charts usually show quantitative data in percents or absolute numbers that are part of a whole, and can dramatize comparisons between parts in relation to the whole. *PFS:Graph* permits plotting up to eight segments. The X axis labels

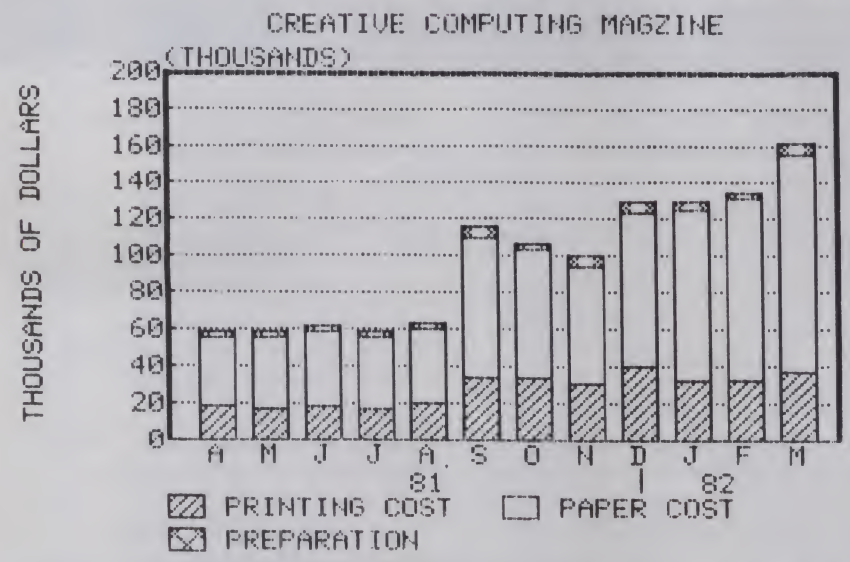

Figure 4. Bars can consist of up to four data points identified by color or shading.

Bar and line graphs may be combined in a single chart. However, if bars are stacked in the bar graph portion, the line graph is stacked on top of the bars. Thus, while I would have liked to show a line graph of the total print run on top of the stacked bar graphs showing printing costs (Figure 4), this was not possible. While *VisiPlot* is more cumbersome in specifying the layout of graphs, it would have allowed me to combine these items. Also, *VisiPlot* allows a line graph to overlap a bar graph, whereas with *PFS:Graph*, the line chart must always be above and separate from the bar chart portion.

VisiPlot permits a "floating" label to be placed anywhere on the chart. *PFS:Graph* does not have this feature.

An outstanding feature of *PFS:Graph* determine the number of segments and Y axis values determine the size of each segment. Whether you want it to or not, *PFS:Graph* always converts the absolute numbers to percentages in the pie chart labels (see Figure 7). Unfortunately, if you want to use the same data for both a bar and pie chart it probably will have to be entered twice because the X labels for a bar chart are likely to be different from those on a pie chart.

For a more pleasing appearance, it may be desirable to rescale a graph. I had one uncomfortable moment trying to rescale the bar graph showing *Creative Computing* Magazine print runs from the 300,000 maximum provided automatically by *PFS:Graph* to a more visually pleasing 250,000 (see Figure 8). I specified a Y axis range of 0-250 and got the graph shown in Figure 9. This is clearly not what I desired, and it took me several minutes to realize that the rescale value must be in terms of the total units (250,000) and not in terms of the value shown on the scale (250). Using the correct value produced the desired result (see Figure 10).

Printing and Saving Graphs

The Print/Plot routine allows any graph to be printed on a Silentype, Epson, or any other printer connected with a Grappler interface card. It may also be plotted on an HP7470A Plotter. The graphs may be printed in both "normal size" (approximately 3" x 4") or in expanded size to fill an 8 1/2" x 11" page. Figures 3 and 4 are printed in the expanded format. Note the much better resolution. All the illustrations for this article, by the way, were printed on a Silentype printer.

A much better copy on paper or transparency may be produced with the HP7470A plotter. The program has an option to halt for a pen change after plotting a given portion of the information. This permits multicolored charts to be drawn. The quality of these charts is outstanding.

The Get/Remove Chart function is used to "save, retrieve or delete" a chart stored on a diskette. I had anticipated that saving a chart in this way would permit it to be retrieved by one of the slide show systems such as the Lotus *Executive Briefing System*, *Screen Director System*, or *C & H Slide Show*. But alas, this does not seem to be possible. The *PFS:Graph* system stores slides in a peculiarly-formatted disk system which

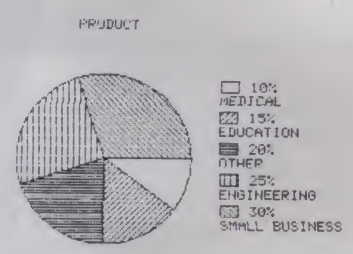

Figure 7. Pie chart values are always converted to percentages.

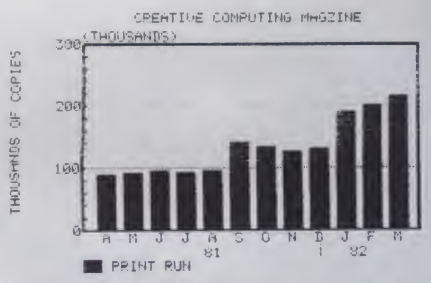

Figure 8. Creative Computing print run, 4/81-3/82. Scaling is chosen automatically by PFS: Graph.

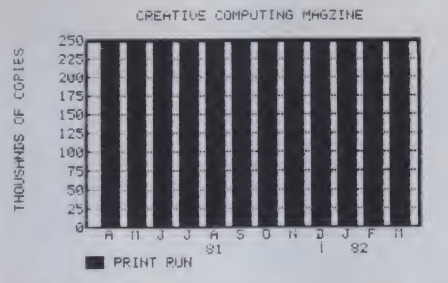

Figure 9. Result of re-scaling Figure 8 using 0 to 250 (the value printed on the axis).

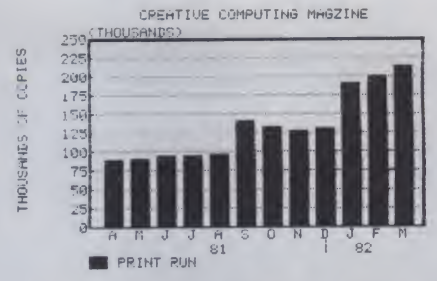

Figure 10. Correct re-scaling using 0 to 250,000 and 25,000 Y-axis dividing lines.

can be read only from the *PFS:Graph* software system (or perhaps from Pascal). Indeed, it is not even possible with Apple DOS to list a catalog from a *PFS:Graph* data disk; nor is it possible to store a graph in the hi-res page and BSAVE it to another disk because the normal DOS is not operative with the *PFS:Graph* system. This is a real pity because, in general, it is easier to make a chart using *PFS:Graph* than with *VisiPlot*. However, the manual gives no clue how to use these graphs with any other system if, indeed, it is possible at all. Thus, as I stated at the beginning, it is necessary to have a printer or plotter if you wish to disseminate the information from *PFS:Graph*.

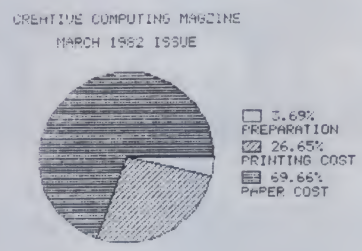

Figure 11. Pie chart percentages are automatically rounded to two decimal places.

The Bottom Line

In summary, *PFS:Graph* is an easy-to-use, versatile system for producing bar, line and pie charts on a Apple computer. The finished graphs can be produced more quickly than with *VisiPlot* and the expanded printer option is a decided plus. The menus are clear and self-explanatory. The ability to graph cumulative data is excellent. On the other hand, *PFS:Graph* is not as versatile as *VisiPlot* in labelling, data manipulation, or combining several graphs on the same chart. Furthermore the manual gives no instructions for retrieving the graphs with any other software system. □

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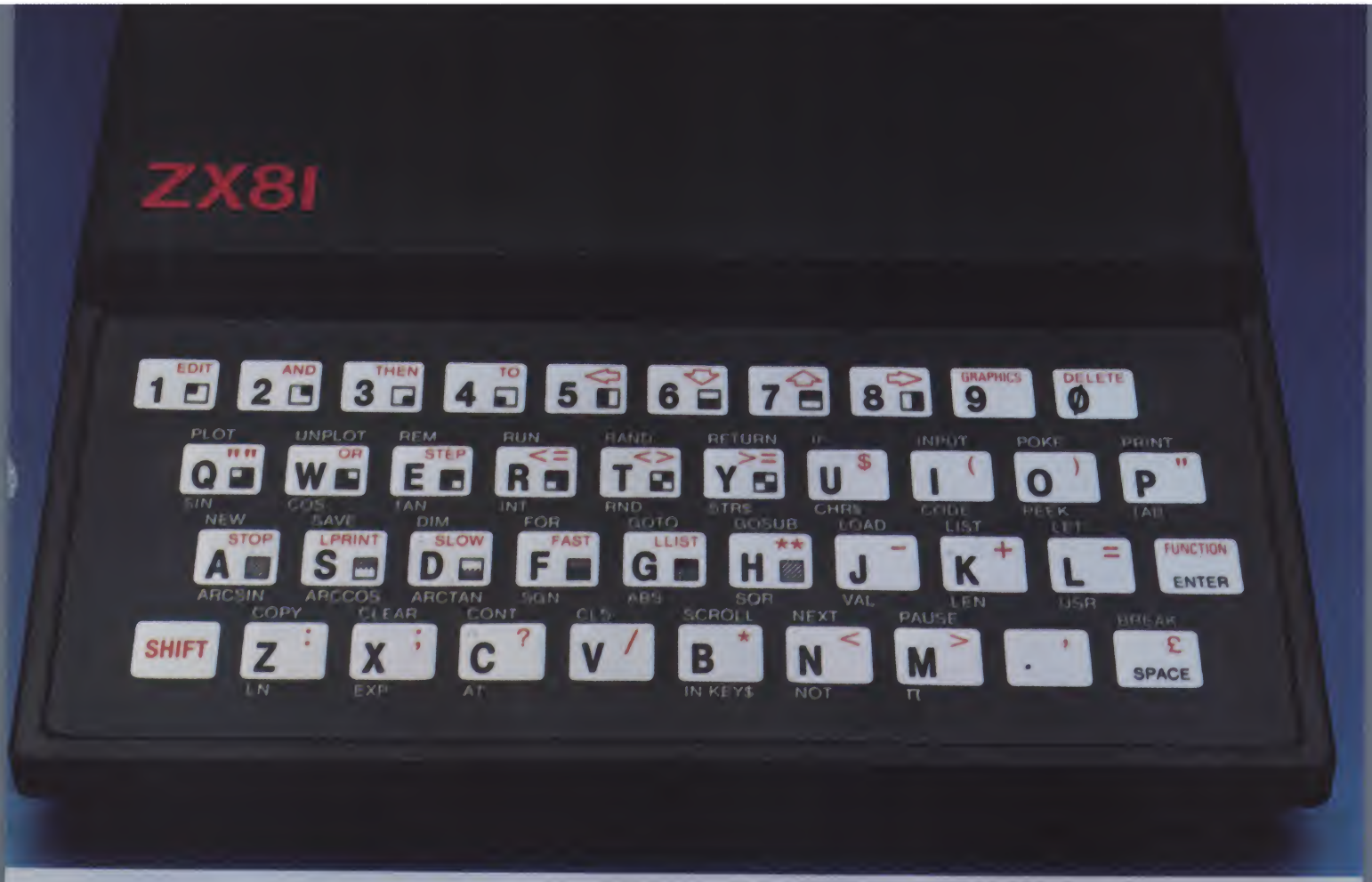

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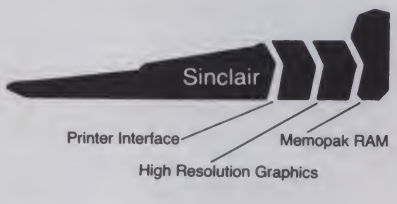

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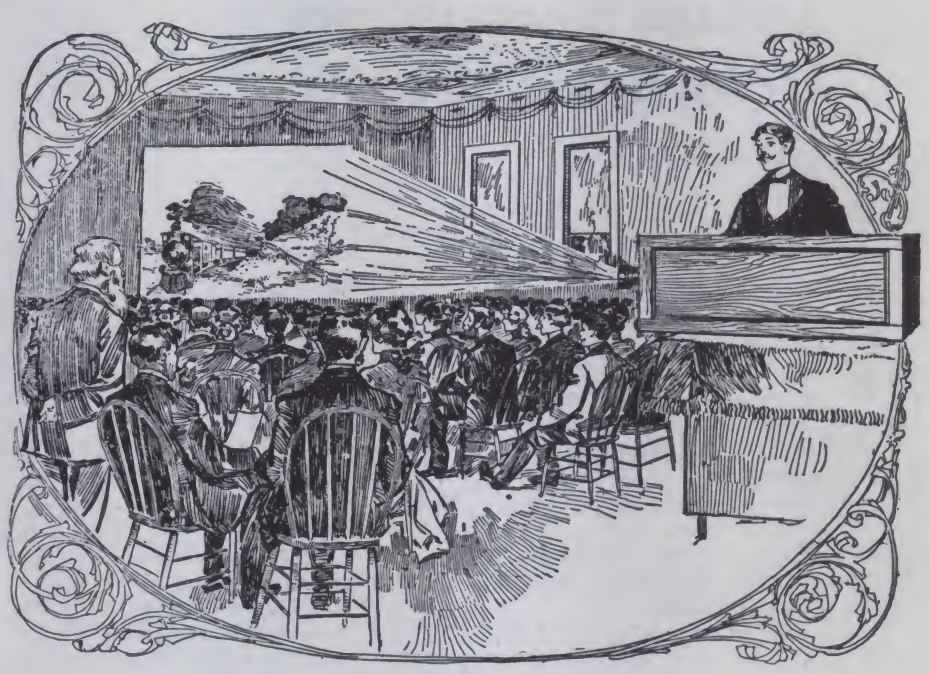
David H. Ahl



From the spate of new product releases, one might conclude that personal computer software vendors are taking aim at Kodak and the slide show market. Within three months, four software packages designed to create electronic slide shows have been released for the Apple alone. Two packages also offer the ability to make up text images (slides), while one additionally offers the capability of making graphic images.

We took a close look at all four systems and their capabilities. In addition, I asked Kerry Shetline of our Software Development Group to write a "Poor Man's Slide Show System." It lacks the elegance and speed of the other systems, but if you don't mind a bit of typing and a seven- to ten-second slide load time, the price is right (free).

ELECTRONIC SLIDE SHOW SYSTEMS FOR APPLE II

	Executive Briefing System	Screen Director	The Slide Show	Apple Flasher	"Poor Man's"
Capability to create or modify text slides	Yes	Yes	No	No	No
Capability to create or modify graphics slides	Yes	No	No	No	No
User Interface	Menu	English-like commands	Menu	Menu	Program command
Images (Slides) per disk	32	17	16	16	16
Slide Transitions:					
Timed automatic (seconds)	2 or more	5 or more	8-999	2-240	8 or more
Keyboard/game button	Yes	Yes	Yes	Yes	Yes
Forward and reverse	Yes	Yes	No	Yes	Yes
Select any slide	Yes	Yes	No	Yes	No
Transitional effects	5	2	20	1	1
Print Slides	Yes	Yes	No	No	No
Pages in manual	157	122	52	6	n/a
Price	$199.00	$150.00	$39.95	$34.50	free

Lotus Executive Briefing System

David H. Ahl

The *Executive Briefing System* is a graphics package designed to present a series of text or graphics "slides" on a monitor or TV set controlled by an Apple computer. The "slides" may be created with the *Executive Briefing System* or with other hi-resolution graphics packages, such as VisiPlot or Apple Business Graphics Package.

The program allows the user to create a slide show on disk which can run automatically or manually using paddle controllers or the keyboard to advance, backup, or view individual slides.

The *Executive Briefing System* package comes complete with a demonstration diskette (the Conoco Takeover), extensive manual including a 95-page tutorial section and 53-page reference section and, of course, the program diskette.

The system requires a 48K Apple, one or more disk drives (two preferred), Applesoft Basic in ROM (or a language card), monitor or TV set (color preferred). Graphics printer and paddle controller are optional.

The system is easy to learn and use. It took me only about an hour before I was comfortable with most of the features and able to produce slides of my own. Quick progress is aided by the excellent tutorial manual which contains screen photos on virtually every other page.

Tutorial Lesson 1 uses the demonstration disk, "The Conoco Auction," to demonstrate how to present a slide show with the EBS run-time program. A slide show can be run automatically with the user specifying the amount of time (in seconds) that each slide is to remain on the screen. If you want to allow more time to read a particular slide or point something out to an audience, the show can be interrupted by simply pressing the space bar. The show is then resumed by pressing any key.

It is also possible to use the right and left arrow keys to advance to the next slide or go back to the previous one. With the show set up for automatic advance, the left arrow key reverses the direction of the show. The Conoco demonstration diskette is set up to display each new slide with a rising curtain effect. However, other effects are possible, including a falling curtain, dissolve, spiral (out from the center), or simple cut. For variation, it is possible to specify "random" which as its name implies, produces a random dissolve to the next slide. All of these parameters may be changed either when the show is being made up or at run time.

One last option at run time is the ability to view a slide out of sequence. By bringing the main menu to the screen during the slide presentation and selecting VIEW, the current slide is replaced by a double-column list of all the slides on the disk. Using the cursor and right or left arrow keys you simply select the slide you wish to view, press Return and it is immediately shown.

Lesson 2 is devoted to creating a slide show diskette with the *EBS* edit program. This lesson also encourages the user to step through all of the menus and become familiar with the creation aspects of the package.

The entire package is menu driven. There are two main menus, one for creation and modification of slides and the other for running a slide show. The Run Time menu has two submenus while the Creation menu has fifteen submenus. While this may sound complicated, in fact it is not. When the cursor is placed over any menu item (all of which are full words), an explanation of that item appears in the top line on the screen. Items needing additional explanation use larger areas of the center of the screen. In the tutorial portion of the manual, the menu is frequently illustrated along with a diagram showing one or two diskettes that indicate what is being transferred between them.

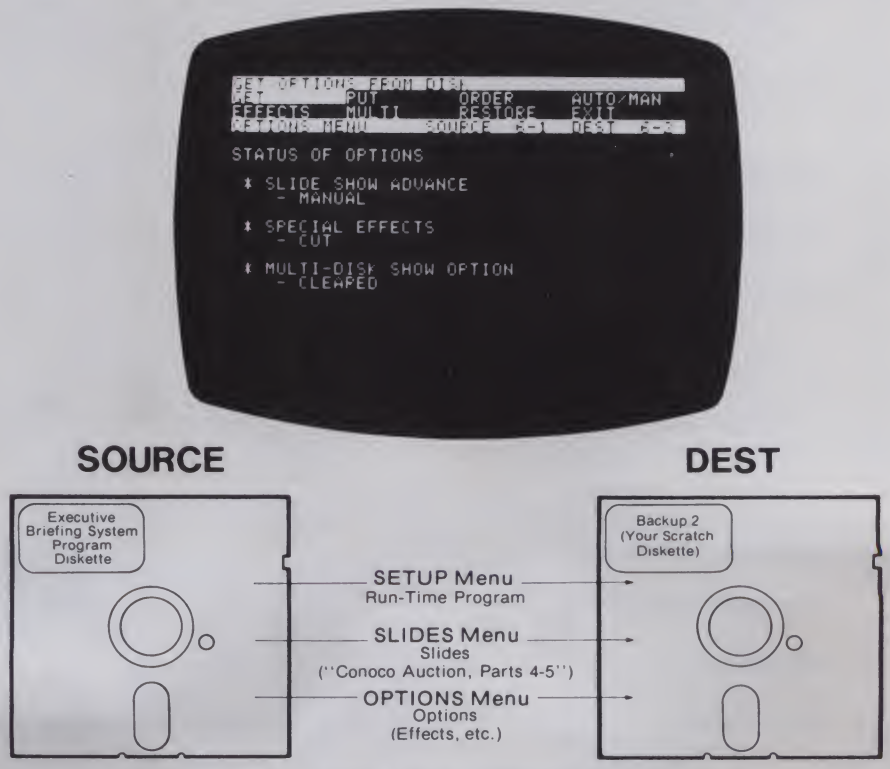
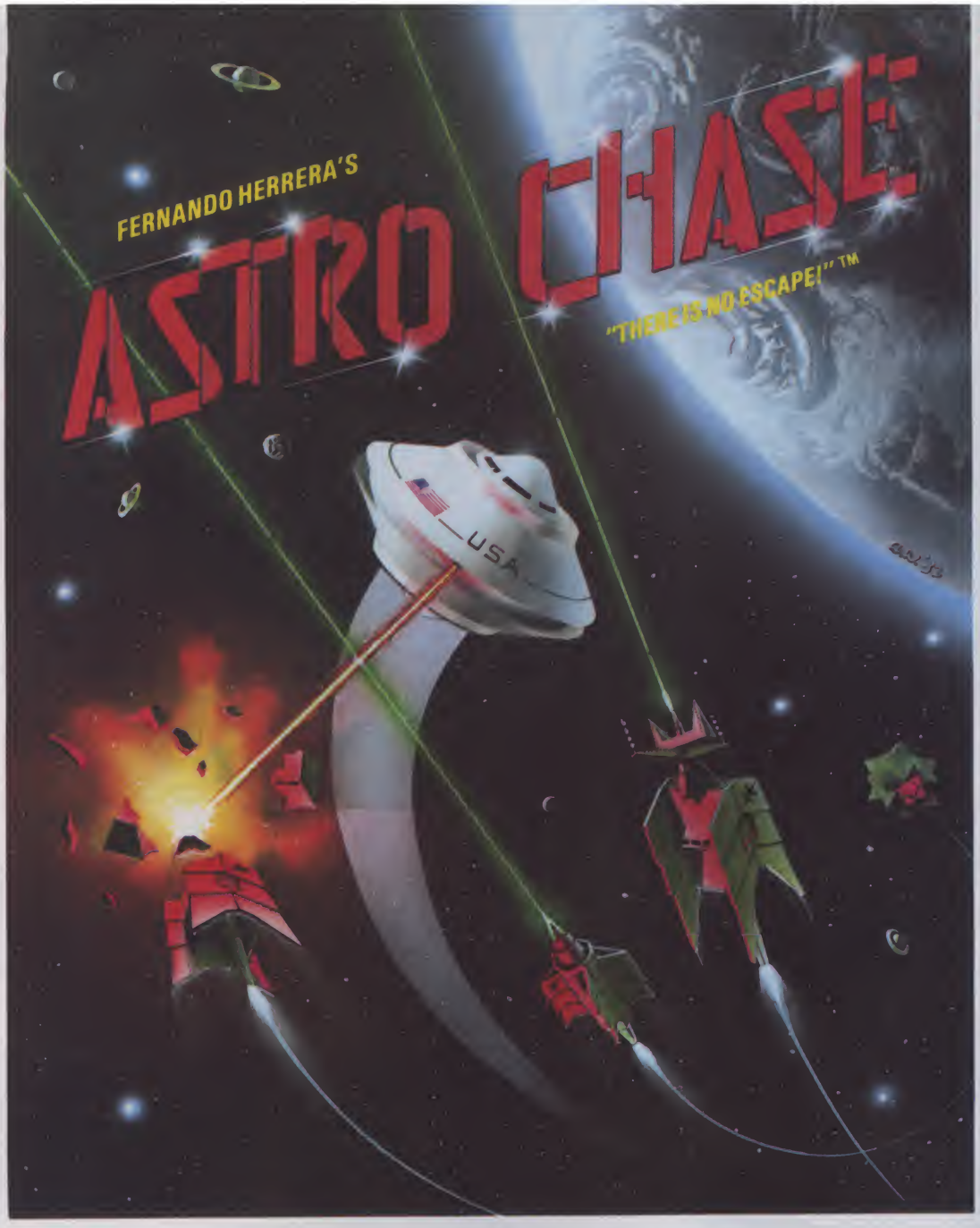


Figure 1. Illustration from manual shows computer screen and diagram of data transfers on disks.



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Lesson 3 comprising the next 30 pages of the manual is a tutorial on typing and drawing slides. For the most part, the cursor behaves the same as it does on a regular Apple except that there is no wrap around at the end of a line or bottom of the screen.

Three type fonts are available: Monospace (upper and lower case, looks like the regular Apple font), Compressed (upper and lower case, about 1/3 smaller than Monospace) and Large Caps (upper case only, about 1/3 larger than Monospace). In addition, all type faces are available in regular or boldface style (upper case letters only) and in reverse (black on white instead of white on black).

If these fonts aren't enough, Lotus has 72 additional fonts (Lotus Alphabets) available on three disks of 24 each ($25 per disk). Some are quite astounding and substitute small graphics characters (hearts, diamonds, etc.) for punctuation marks.

While it is possible with all the type faces to go wild in creating "spectacular" slides, I found that by sticking to one or two type fonts and styles I produced a far more readable finished slide. I also found that lower case Compressed was barely readable in color, even on a high quality color monitor. Hence, I avoided this style except where I had to squeeze a caption into a very small space.

In addition to text, *EBS* provides the ability for doing both high and low resolution drawing. Although the manual states, "the possibilities are limitless," we found that drawing with a one-pixel wide cursor using the keyboard was extremely tedious. On the other hand, we won't deny that folks with the patience of Job will be able to produce some outstanding graphics. Witness those on the Conoco demonstration disk and in the manual.

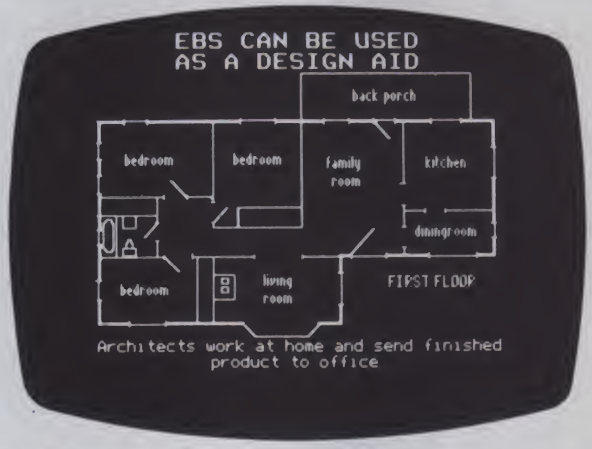

Figure 2. Detailed slides can be produced using the "Draw" feature.

In both the text and drawing modes, six different colors are available: green, purple, orange, blue, white and black. Black, of course, is most useful for erasing mistakes made in the other colors.

In the drawing mode, there are two different cursor sizes: regular (the same as the standard Apple cursor) and micro cursor (1/6 the size of the regular cursor or one-pixel in width). There are also two other cursors provided, one is six pixels high and the other six pixels wide. Although interesting, I never found any real use for either of them.

The fourth tutorial lesson addresses creating and backing up a single or multi-disk show. It emphasizes the importance of back-up disks, and explains the use of the "help" menu. It also explains how to print slides with the Silentype, Epson and IDS printers.

Although I created some slides using the draw features of the *Executive Briefing System*, I found it far easier to create graphs and charts using VisiPlot and load them into the *Executive Briefing System*. Incidentally, you must save the pictures created in VisiPlot using PIXSAVE, a command which is rarely used if you are using VisiPlot by itself. *Executive Briefing System* gives instructions for transferring files from one disk to another, however I found it just as easy to save the VisiPlot pictures directly on my *EBS* data disk. *EBS* will save slides in either a packed or normal format.

One minor annoyance: once a name has been assigned to a slide, it is extremely difficult to change it without several disk transfers. A word to the wise: think out the name for each slide and make it as short as possible so that it will fit on the screen when you view the directory menu. Remember, only 16 characters will be visible.

When editing slides created by VisiPlot, you'll find that the text lines are not in the same place. Hence, it will not be possible simply to overwrite a title line. In fact, to erase certain areas of the VisiPlot screen such as the nasty numbers which are always printed on the X axis and which I rarely want, it is necessary to use the full-size cursor to erase most of them and the micro cursor (drawing in black) to erase the top three pixels. On the other hand,

"My subscription to Creative Computing just expired!"

creative computing

SOFTWARE PROFILE

Name: Lotus Executive Briefing System

Type: Business graphics package

Author: Mitchell Kapor

System: 48K Apple, Disk Drives

Format: Disk

Language: Applesoft Basic with machine language routines

Price: $199.00

Manufacturer:
Professional Software Technology Inc.
180 Franklin St.
Cambridge, MA 02139
(617) 497-2077

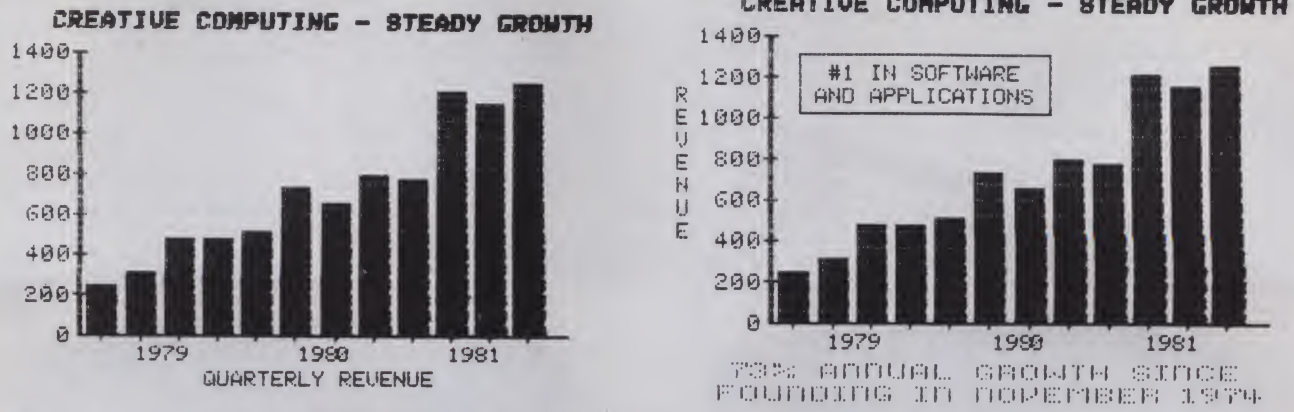

Figure 3. Graph produced by VisiPlot can be modified to include labels, colored type and borders.

the effort was well worthwhile as I was able to get a far more attractive final slide using the combination of VisiPlot and the *Executive Briefing System* than using VisiPlot alone.

In summary, the *Executive Briefing System* is easy to learn, easy to use, and produces professional results in a minimum amount of time. Applause goes to the author, Mitch Kapor, for following his successful *VisiTrend/VisiPlot* package with the *Lotus Executive Briefing System.* □

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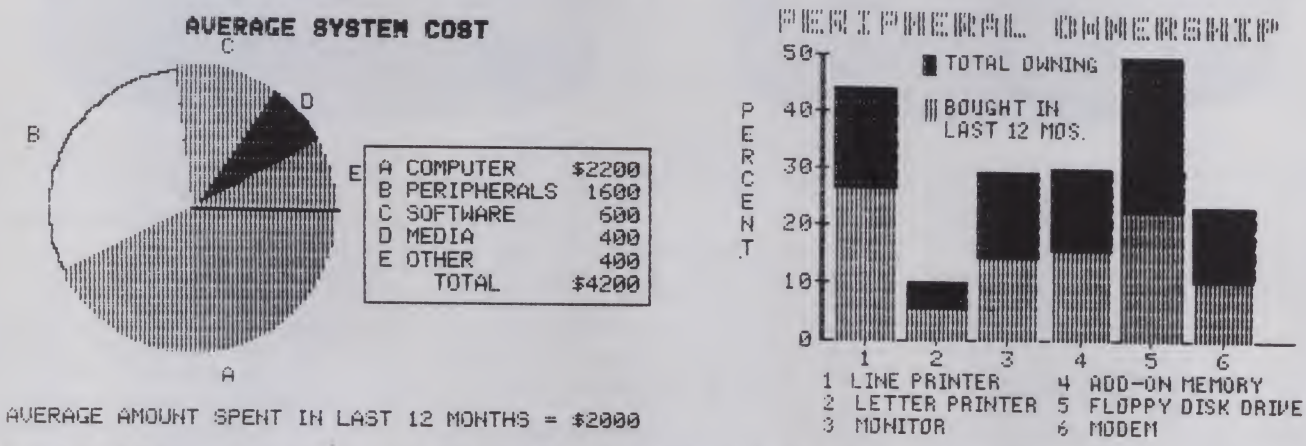

Figure 4. Line printer output is not as good as the screen since colors are not clearly differentiated.

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CIRCLE 133 ON READER SERVICE CARD

Screen Director

David H. Ahl

As the software world moves toward making software packages more user-friendly, there seem to be three distinct approaches. The first I call KISS, for Keep It Simple, Stupid. The "attract" mode on a game is an example of this. By watching the computer play for a while, you can get the hang of the game, and are able to move right into it without any further instructions. In general, this approach does not work for larger, more complex software packages. The majority of those programs today use a menu-driven approach. For example, the Visi-series of programs, PFS and Lotus packages all rely heavily upon a menu-driven approach. The third approach is to make software packages accept English-like commands. An extreme example of this is *The Last One*. In some sense, the Cobol language was a forerunner of the English-like approach to simplicity.

In any event, Business & Professional Software, Inc. have chosen the English-like approach to make *Screen Director* a user-friendly package. In effect, *Screen Director* is a mini-language for creating and showing slides in contrast to, say, the Lotus *Executive Briefing System* which is a completely menu-driven system. Since the approaches are so completely different, I can say with a reasonable degree of certainty that if you like one you will not like the other.

The *Screen Director* system consists of a manual (10 chapters, 4 appendices), a Kodak hand-held remote slide projector controller with a connector that plugs into the game port on the Apple computer, and two disks. One disk holds the *Screen Director* program, and the other is a demonstration disk with several slides and sample data.

Using a graphics package such as the *Apple Business Graphics* package or *VisiPlot*, the user creates graphic images which are stored on a data diskette. These can then be accessed from the *Screen Director* program, arranged in sequence and shown as an electronic slide show. The *Screen Director* also has the ability to create and edit text slides. It will print both graphic and text slides on a wide variety of printers including the IDS prism printer for full color output.

As I mentioned earlier, *Screen Director* uses a set of English-like commands at the system command level. The basic structure of a command is:

Verb (noun) (preposition) (modifier(s)).

Command elements in parentheses are not used in all commands. Some examples of commands that *Screen Director* understands are:

```
CLEAR TITLES
LIST DESCRIPTIONS PRINTER
SET TITLE "OIL IN THE US"
DISPLAY IMAGE SHOW: OILAXES.S.DATA
ADD
LIST
VERIFY
CREATE SHOW: BOOK SALES
SHOW FROM 8 AUTOMATATIC 10
REMOVE FIRST, 4, 8 THRU 10
MOVE 3, 5-9, LAST BEFORE 1
HELP EDIT
HELP SETUP
```

As you can see from this short list, *Screen Director* has its own language. But it is a rather natural language. I found by laying the reference card on top of the Apple, I could pretty much figure out how to create a slide show without constantly referring to the manual. Of course, I did read the manual first!

Chapter 1 of the manual is simply a description of the *Screen Director* system. Chapter 2 plunges right into a tutorial which takes you through creating a presentation (using the sample data on the second disk), making a title slide, showing the slides manually and automatically, and saving the finished show on a disk. By the time you have finished the 17 pages of this chapter, you will probably have more questions than answers. This is because many of the commands are presented simply to enable you to get your hands on the computer and show what it can do; the explanations for the commands are not given until later in the manual.

Chapter 3 presents some of the concepts of a slide tray and screen. There are three main types of screens. The first is an image such as a line graph, area plot, bar graph, picture, etc. A text screen, as its name implies, holds alphanumeric text. A message screen flashes short messages on the monitor during a presentation for instance, to remind the user to change diskettes in the drive.

Chapter 4 defines the basics of the *Screen Director* language. It also lists valid file and disk names.

Chapter 5 starts getting into the meat of things. It describes how to set up a disk for the creation of a slide show. It also describes the help commands. These are incredibly useful, particularly when you are first learning the system. There are eight help commands which describe all the other commands. In addition, there are two levels of help. The first simply describes the commands and their structure for, let's say, setting up. Typing CONTROL-A while in one of the eight help files will show you an explanation of the use of each command.

Chapter 6 deals with creating and saving a tray of slides. Note that the terminology throughout *Screen Director* is as close as possible to that used by someone showing a Kodak carousel tray of slides.

Each slide in the tray must be completely defined; it is not enough simply to give the name of the image. Five char-

creative computing

SOFTWARE PROFILE

Name: Screen Director
Type: Slide show utility
System: 64K Apple, disk drive
Format: Disk
Language: Pascal
Summary: Electronic slide show
Price: $150
Manufacturer:
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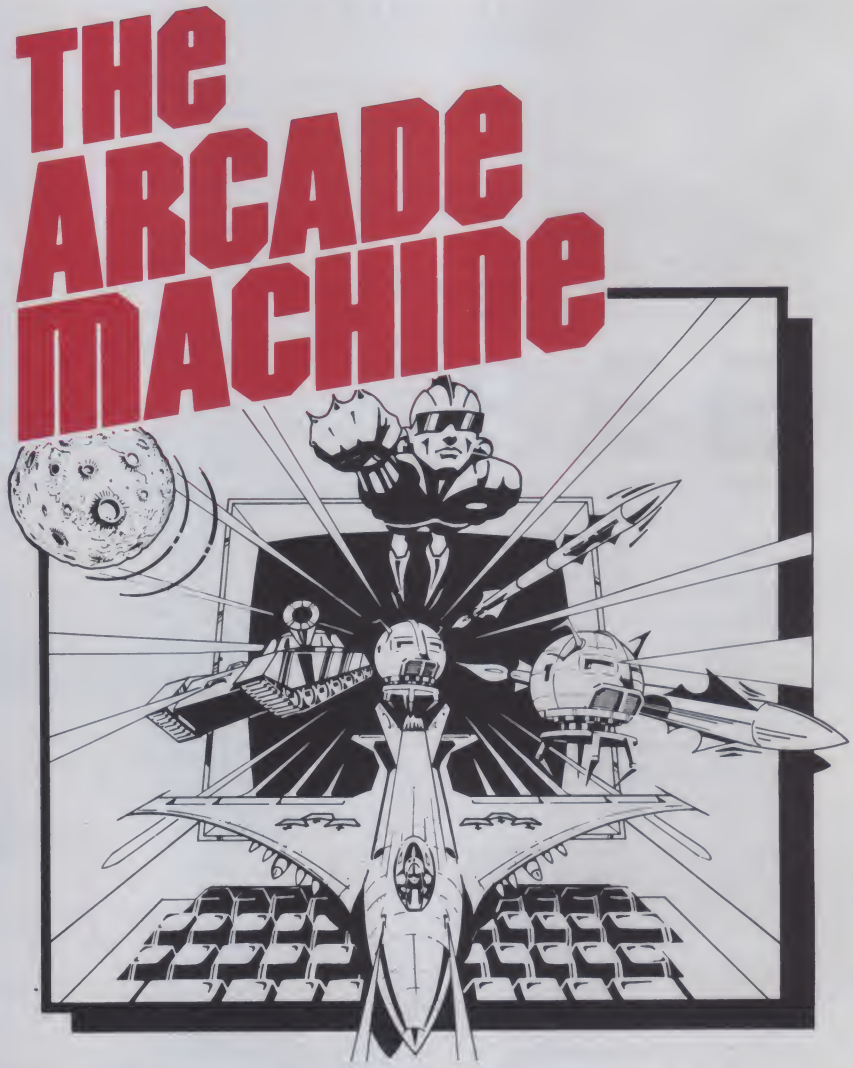

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Vol. 1 No. 1

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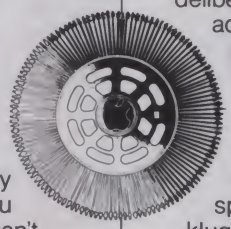

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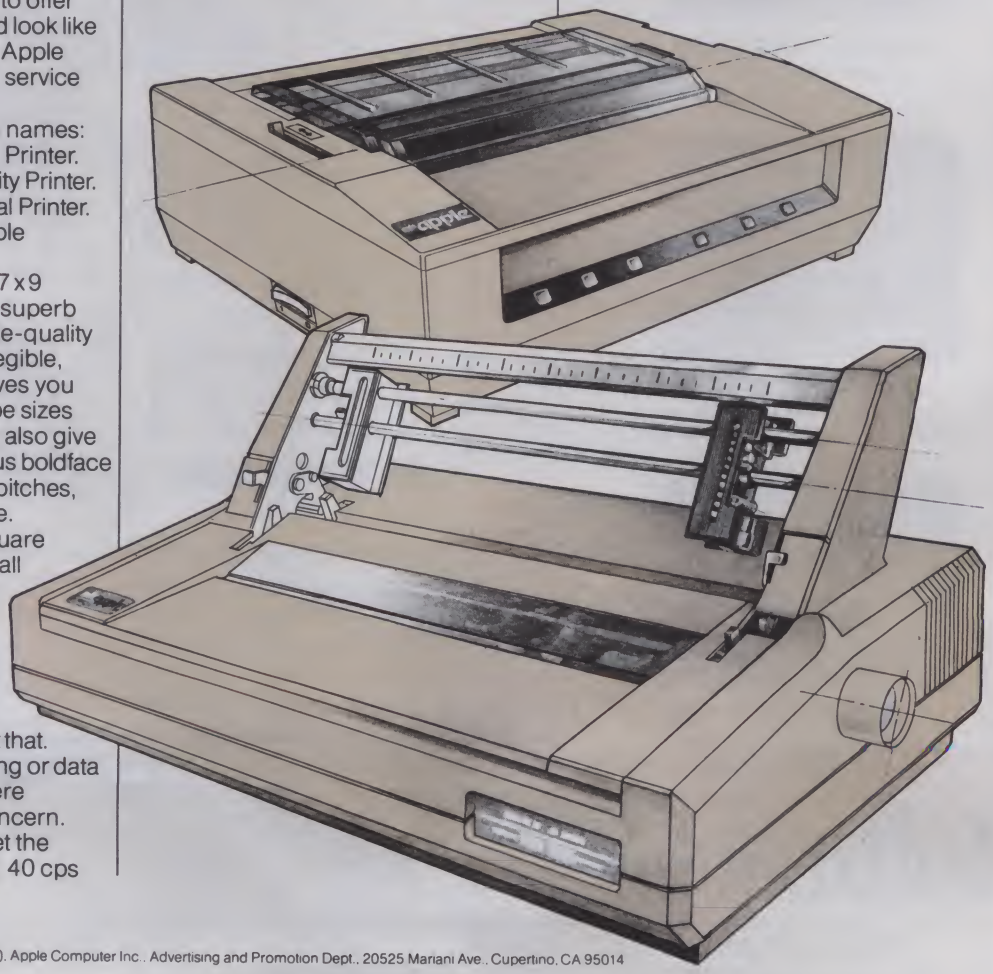

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acteristics are necessary to define a slide: screen type (image, text, etc.), file (file and slide name), description, flash screen (yes or no) and display time. Flash screen means showing the slide like a blinking cursor; this really gets your attention! Figure 1 shows a list of slides in a tray with their characteristics.

```
#1  SCREEN TYPE=    IMAGE
    FILE=           SHOW:OILAXES.S.DATA
    DESCRIPTION=    OIL AXES
    FLASH SCREEN=   YES
    DISPLAY TIME=   0

#2  SCREEN TYPE=    IMAGE
    FILE=           SHOW:OILCONS.S.DATA
    DESCRIPTION=    OIL CONSUMPTION 1960-1978
    FLASH SCREEN=   NO
    DISPLAY TIME=   0

#3  SCREEN TYPE=    IMAGE
    FILE=           SHOW:OILPROD.S.DATA
    DESCRIPTION=    OIL PRODUCTION 1960-1978
    FLASH SCREEN=   NO
    DISPLAY TIME=   0

TYPE <CTRL-C> TO CONTINUE, <ESC> TO EXIT

#4  SCREEN TYPE=    IMAGE
    FILE=           SHOW:OILIMPO.S.DATA
    DESCRIPTION=    OIL IMPORTS 1960-1978
    FLASH SCREEN=   NO
    DISPLAY TIME=   0
```

Figure 1. List of four slides and their "characteristics."

Chapter 7 describes how to clear and set default values such as display time, screen type, and flash screen.

Chapter 8 describes how to make changes to trays you have created and saved previously, and also describes how to combine one or more trays, add screens, remove screens, and change their positions and characteristics. Frankly, I found this chapter somewhat confusing and I got myself into several predicaments which could only be remedied by restarting the system. I am not sure whether this was the fault of *Screen Director*, the 32K memory board in my Apple, or a raging thunderstorm outside. On the other hand, it was not a one-time occurrence.

Chapter 9 describes various procedures and commands used for presenting a tray of screens (slides). It first recommends the use of the verify command to make sure that all the screens you want to use are on-line and then goes into the show command for presenting the tray either manually or automatically. In automatic presentation mode, the slides may be shown for the same amount of time (specified at show time) or for the display time specified on each slide. In addition, if you wish to view a slide longer than the display time or automatic time, you may simply press the space bar and that slide will stay on the screen until the space bar is pressed again.

Chapter 10 describes the creation of a text screen for inclusion in your graphic slide presentation. Unfortunately, there is no provision for adding, deleting, or editing material on a graphics slide as there is in the Lotus *Executive Briefing System*. I found this a disadvantage, as the slides that I created on *VisiPlot* were not always in the final form in which I wanted to show them. Furthermore, *VisiPlot* has only one size type and I would like to have been able to use the large and inverse type faces available in *Screen Director*.

Slides may be printed on any one of several line printers as well as the IDS Prism Color Printer. Unfortunately, the entire show must be printed automatically or manually. No provision is provided for printing individual slides, say slide 7 or slide 13, from a show. Trying to print to a printer whose slot has not been specified hangs the system. Your only recourse, then, is to re-start.

Screen Director permits 17 image (graphics) screens to be stored on a disk. I felt this number was rather low, particularly in light of the many excellent hi-res packing routines on the market. For example, the Lotus *Executive Briefing System* stores 32 screens on a disk. Perhaps the reason that a disk stores so few slides is that *Screen Director* stores much additional information about each slide.

Although a Kodak slide projector control is provided, you may also use the push buttons on a set of paddles or joystick. One button moves the show forward one slide while the other moves it backward. Sorry, there is no focus control.

In contrast to the *Executive Briefing System*, which has several methods of switching from one slide to the next (downward roll, upward roll, dissolve, etc.), *Screen Director* has only two slide change methods: dissolve and overlay. The overlay is rather interesting. For example, if you wished to show a graph of oil consumption as one slide followed by a graph of oil production and oil imports as the next two slides, each could be overlaid on the previous slide as shown in Figure 2.

In summary, *Screen Director* is an excellent program for displaying hi-res graphics made by some other program along with text slides produced by *Screen*

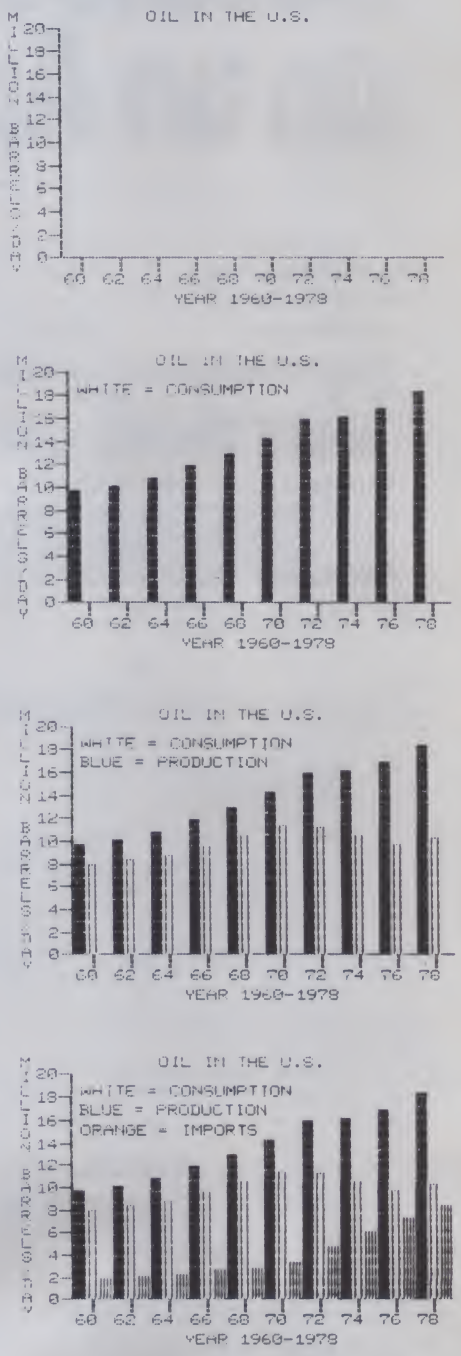

Figure 2. "Overlay" dissolve technique allows an image to be overlaid on a previous one. Here, three images are overlaid.

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Screen Director, continued...

Director. This electronic slide show capability should be valuable in business and industry. The English-like commands will appeal to many users. The program may have a special appeal to Pascal users since it is written in Pascal and allows the running of other Pascal programs, such as *Apple Business Graphics*, from within the *Screen Director* program. The inclusion of a Kodak slide changer is a nice touch. On the other hand, the system falls short in its ability to modify or edit graphs or charts produced by another software system. Assuming you are happy with the output produced by *Apple Business Graphics* or *VisiPlot*, this is not a severe limitation. The ability to overlay one slide on the previous one is excellent, however, I would have liked to see greater visual versatility in the slide changing methods.

While the English-like commands combined with the eight help screens and reference card made using the system reasonably straightforward, I was still obliged to consult the manual more often than I do with a good menu-driven system. Also, it was not at all clear from the manual that loading an image from *VisiPlot* or some other system, displaying it, and storing it as a slide would require a disk change although common sense tells you that this must be so. (Note: none of the other slide systems deal adequately with this operation either, although it is extremely vital.)

Screen Director is not for everyone. If you like writing programs or have learned a foreign languge in school, you will have no trouble with it and will find it does an extremely competent job. On the other hand, if you are oriented to off-the-shelf, packaged software of the KISS or menu-driven variety, you should take a look at the *Screen Director* manual at your local computer store before sinking $150 into it. □

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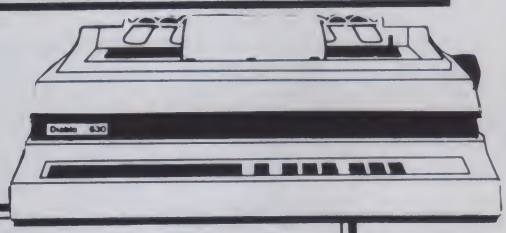

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Slide Show

David H. Ahl

The Slide Show is a software package designed to allow the Apple computer to emulate a 35mm slide projector on a TV or monitor. Since the authors are mainly involved with videotape production, they have put much emphasis on video-like special effect transitions between standard hi-res pictures (slides). *The Slide Show* provides 20 different transitions to use between images.

In contrast to the Lotus *Executive Briefing System* and the *Screen Director* system, *The Slide Show* has no provision for creating slides; rather it is simply a system to take hi-res images created by other software packages and show them in sequence.

A slide sequence may contain up to 75 hi-res images. Although a maximum of 16 images may be stored on one disk, the program works with single or multiple disk drives, so longer sequences can be shown.

The Slide Show provides three methods of advancing slides. For a show under the control of the operator, either the paddle button or a key press may be used to advance the slide. Alternatively, slides can be set to run automatically with the timing of the slide advance set at anything between eight seconds and seventeen minutes. Furthermore, these methods may be intermixed in a slide show.

The manual is divided into five sections. The first section is an introduction and describes the features of the system. The second section takes you step by step through running a demonstration sequence which is included on *The Slide Show* disk.

The third section of the manual describes the seven main commands in the menu. They are: Create, Display, Erase, Load, Modify, Print and Save.

The fourth section comprises the bulk of the manual (28 pages). It is a tutorial which takes you through all the features of the system. The balance of the manual consists of six appendices and an addendum.

The Slide Show system is completely menu-driven; the only thing you will ever have to type is the name that you wish to assign to a slide and the file name under which it is currently stored on a disk.

The two commands used most are Create and Display. Create is the option used to create a slide sequence. Upon selecting Create, the program asks you to enter the name of the slide and press RETURN. The name of the slide is the same as the filename of the hi-res image on the disk. The menu then allows you to select the drive number from which the slide will be loaded. Following this, the program prompts you for the type of slide advance to be made from Slide 1 to Slide 2. If you do not select a type of advance, the program will automatically default to a key press of any key. The program then asks you to input the letter for the type of transition between Slide 1 and Slide 2. The 20 transitions available are shown in Figure 1.

The list of transitions is provided as Appendix D in the manual or may be shown on the screen by pressing CONTROL-L. After selecting a transition, Create goes back to Step 1 and asks you for the name of the next slide in the show.

When you have finished the creation process, ESCAPE takes you back to the main menu from which you may select another option.

To view the show that you have created, you simply press D for Display. There are no options with the Display command: you simply see the show as you have created it.

The Modify option steps through a show in the following order: slide name, type of slide advance, and type of transition. If you wish to change an item, you simply type over the existing information or use the menu to select a different option.

Save, as its name implies, saves a slide show sequence on a disk. Load brings it back in, and Erase eradicates it from memory (but not from the disk). With the Print option, a slide show sequence may be printed on a line printer. Note that it is the sequence of slides that are printed and not the hi-res images.

The Slide Show package includes three important programs which are external to the menu-driven portion of the system. The Initialize and Copy programs allow a new disk to be initialized and slides to be copied on to it. Using Copy, 16 hi-res slides may be copied on one disk. This is two more than could be "normally" copied using FID or another standard copy program. On the other hand, the images are not packed nearly as densely as they can be with some of the "picture packer" routines.

Another program, Create Run-Time, allows a complete slide show along with

APPENDIX D - LIST OF SLIDE TRANSITIONS

A) COLUMNS	K) NORMAL CHANGE
B) COLUMNS 2	L) OVERLAY DOWN
C) HALVES IN	M) OVERLAY L/R
D) HALVES OUT	N) PSEUDO-DISS 1
E) HALVES W/BLUE	O) PSEUDO-DISS 2
F) HORIZ L/R FAST	P) QUADS
G) HORIZ L/R RIPPLE	Q) RIPPLE
H) HORIZ L/R SLOW	R) THIRDS
I) HORIZ L/R FAST	S) VERT DOWN
J) HORIZ R/L SLOW	T) VERT UP

Figure 1. List of 20 types of transitions from one slide to the next.

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SOFTWARE PROFILE

Name: The Slide Show
Type: Slide show utility
Authors: Bruce A. Cash, Robert W. Hench
System: 48K Apple, disk drive
Format: Disk
Language: Applesoft Basic
Summary: Electronic slide show
Price: $39.95
Manufacturer:
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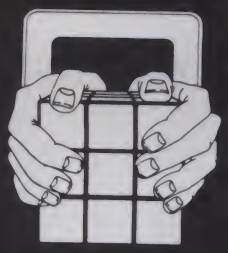

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Slide Show, continued...

all the display information to be stored on a run-time disk. The Create Run-Time program is menu-driven and very easy to use.

In summary, *The Slide Show* is an easy-to-use package for the creation of an electronic slide show. While it is unlikely that anyone would want to use all 20 transitional effects, it is nice to have such a large selection available. The manual, unfortunately,does not do justice to some of these effects. I would have liked to have seen some screen illustrations in the manual and a summary of the menu commands. Also, the long tutorial section and absence of an index in the manual made the going rather slow.

On the other hand, the menu-driven nature of the system combined with the relatively complete explanations of the allowable commands at any particular point made using the system relatively straightforward and trouble free. I would have liked to see a high density packing routine used for storing images on a disk to allow more than 16 images. Nevertheless, *The Slide Show* meets its goals with nerve and, if you are not looking to create or modify images created with other programs, represents a good buy for $39.95. □

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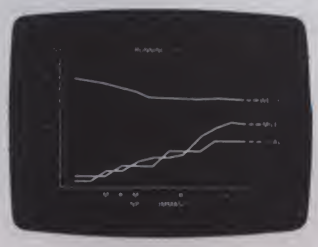

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Apple Flasher

David H. Ahl

Apple Flasher is a software package designed to find and display hi-res pictures which have been stored on disks by other Apple programs.

Hi-res graphic images stored on disks as binary files must be loaded into an area of the memory, normally designated hi-res Page 1 or Page 2, in order to be seen. The normal load routine supplied with Apple DOS takes about 10 seconds to load a hi-res image after the name of the file has been typed by the user. *Apple Flasher* both automates and speeds up this display process. The system is almost entirely menu-driven and requires only one keystroke to execute each command.

After loading the *Apple Flasher* disk, a logo screen is displayed and you are invited to "press any key." The program then asks you to place a picture disk in Drive 1. At this point, you may remove the *Apple Flasher* disk and put it away. On the other hand, if you have two drives, you may press 2 to use Drive 2 instead of Drive 1. Pressing any other key will then read the names of the files into the *Apple Flasher* program.

Once these files have been read in, the menu screen appears showing the names of the files along with a letter (A to P) assigned to each filename.

creative computing
SOFTWARE PROFILE

Name: Apple Flasher
Type: Electronic slide show
Author: Paul W. Mosher
System: 48K Apple, Applesoft, disk drive
Format: Disk
Language: Applesoft Basic
Summary: No-frills slide show
Price: $34.50
Manufacturer:
Crow Ridge Associates, Inc.
P.O. Box 90
New Scotland, NY 12127

The menu then allows you to enter one of three display modes: Scan, Projector, and Auto-Display.

Scan automatically shows in sequence all the pictures in the most recently read disk drive. The pictures are shown for about two seconds each so this is an efficient way to search a disk quickly for a particular picture. The Scan may be halted temporarily by striking any key; it is resumed in the same way.

Striking the space bar during a Scan makes the display show information about the picture on the bottom four lines of the screen. This information consists of the letter that has been assigned to the picture, the filename, and the time in seconds which that picture is to be displayed in the Auto-Display mode.

Projector mode imitates the action of a carousel slide projector. When this mode is selected, the first picture on the disk is displayed. By using either the game paddle buttons or the arrow keys you can move ahead to the next picture or back to the previous one. Paddle Button 0 or the right arrow key moves ahead, while Button 1 or the left arrow key moves backwards.

The Auto-Display mode shows each picture for the amount of time specified in a timing code "hidden" in the name of the file. Using time codes, you can create sequences of pictures that will be displayed for varying lengths of time according to their content. The time interval may be varied between two seconds and four minutes. As in Projector mode, any key will interrupt the display.

Timing codes are put in the picture names with a separate Applesoft program or keyboard routine. This routine is shown in Figure 1. Note that this portion of the *Apple Flasher* system is not menu-driven and requires a fair amount of typing on the part of the user. We are told by Crow Ridge Associates that they will soon be releasing *Showmaker*, a utility for setting up slide shows including an automatic method of placing time marks in the picture files. Nevertheless, I did not find the existing procedure too onerous and found I could make a display disk in about the same amount of time as it took with one of the more sophisticated systems.

On the other hand, in contrast to the *Executive Briefing System* or the *Slide Show*, *Apple Flasher* does not offer the user any choice in transition effects, nor does it offer the ability to create or edit slides.

The manual is skimpy but adequate. The author assumes that the user knows how to use his Apple and create hi-res images.

Unfortunately, no provision is made to put the run-time system and a slide show on a single disk. This would be highly desirable so you could make a show, store it on a disk, and distribute multiple copies to stores, sales people, or other members of your organization. In its favor, *Apple Flasher* is a straightforward, easy-to-use electronic slide show system at a modest price. It is what it claims to be, "a convenient, rapid way to find and display hi-res pictures," in a no-frills package. □

CIRCLE 345 ON READER SERVICE CARD

```
(1) Boot with an ordinary DOS 3.3 disk
    Do not use the APPLE FLASHER disk for this process!
(2) Place the disk with the picture in drive 1
(3) Type HGR so you can see screen 1 -- it'll be black
(4) Type BLOAD MYPIC,A$2000 -- you'll see your picture
(5) type FOR N = 8312 TO 8319: POKE N, 0: NEXT
(6) Type Poke 8314, 20 <--this is the number of seconds
(7) Type BSAVE MYPIC,A$2000,L$2000
```

Figure 1. Procedure to put timing codes on slides.

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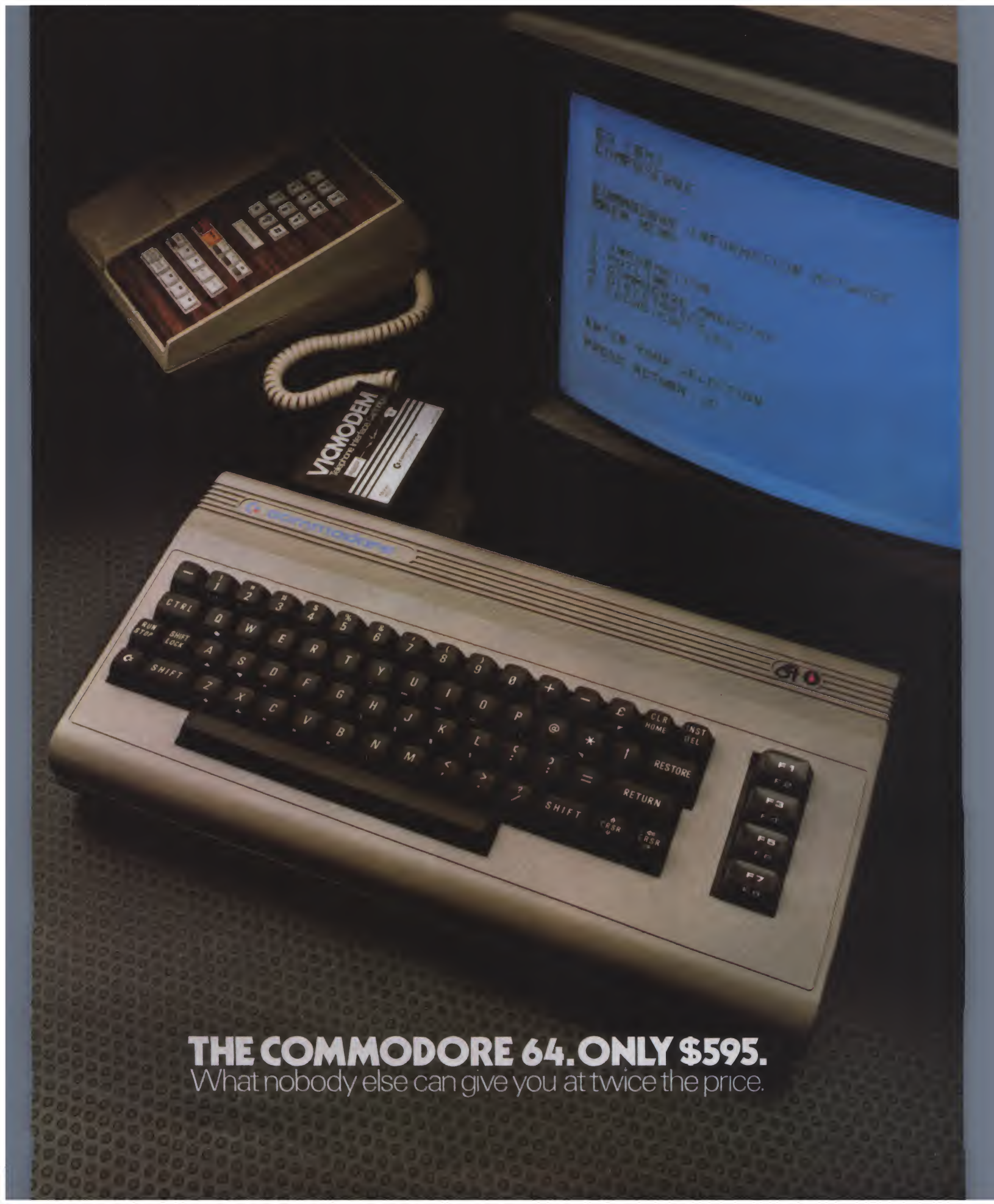

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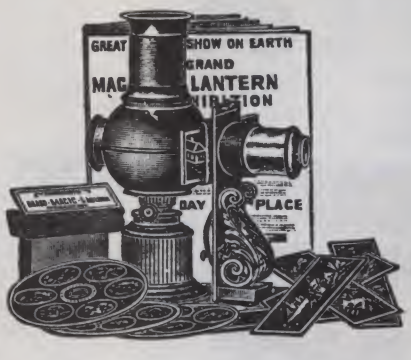

Poor Man's Slide Show System

Kerry Shetline

This is a short program in Basic that will do a "slide show" presentation of hi-res pictures on the Apple. Load the program, then insert the disk containing your pictures in Drive 1. Type RUN, and the program asks if you wish to see a catalog of images (slides) on the disk. You are then prompted to type the names of the pictures you want displayed in their proper sequence. Press RETURN without typing a name when you are done. If you make a mistake, enter a "/" instead of a file name and the procedure starts over.

After all the names have been entered, the program automatically starts to load and show the slides.

The program can be controlled by paddles or keyboard. Use the right arrow or Button 1 to advance through the pictures, and the left arrow or Button 0 to move backwards. The program immediately displays the next picture in the sequence when you push the paddle button or arrow key. While that picture is being viewed, the next picture in the sequence will be loaded. You will hear a beep when the load is completed (about 6-10 seconds) and can move on to the next picture at that point. You may stop the program by pressing ESCAPE. □

```
100 REM] Creative Computing slide show program, by Kerry Shetline
110 DIM A$(14): B0=49249: B1=B0+1: S1=49236: KB=49152: CKB=49168: L$=CHR$(4)+
    "BLOAD ": S$(0)=",A$2000": S$(1)=",A$4000"
120 ONERR GOTO 290
130 DEF FNP(X)=X-1+(P+1)*(NOT X): DEF FNF(X)=X+1-(P+1)*(X=P)
140 TEXT: HOME: PRINT: PRINT: INPUT "DO YOU WISH TO SEE THE CATALOG?";R$:
    IF LEFT$(R$,1)="Y" THEN
      PRINT: PRINT CHR$(4)"CATALOG"
150 PRINT: PRINT "ENTER THE NAMES OF THE PICTURES:": PRINT
160 FOR P=0 TO 14:
      PRINT "PICTURE #" CHR$(32*(P(9));P+1;: INPUT A$(P):
      IF A$(P)="" THEN 190
170   IF A$(P)="/" THEN 140
180 NEXT P
190 P=P-1: HGR: POKE 49234,0: D=0: S=0: PN=0: PRINT L$;A$(0);S$(0): PRINT L$;
    A$(1);S$(1)
200 PRINT CHR$(7): POKE CKB,0
210 K=PEEK(KBD):
    IF PEEK(B1)>127 OR K=149 THEN 270
220 IF PEEK(B0)>127 OR K=136 THEN 250
230 IF K=155 THEN
      POKE CKB,0: TEXT: HOME: END
240 GOTO 210
250 PN=FNP(PN):
    IF D THEN
      S=NOT S: POKE S1+S,0: PRINT L$;A$(FNP(PN));S$(NOT S): GOTO 200
260 D=NOT D: PRINT L$;A$(PN);S$(S): PRINT L$;A$(FNP(PN));S$(NOT S): GOTO 200
270 PN=FNF(PN):
    IF NOT D THEN
      S=NOT S: POKE S1+S,0: PRINT L$;A$(FNF(PN));S$(NOT S): GOTO 200
280 D=NOT D: PRINT L$;A$(PN);S$(S): PRINT L$;A$(FNF(PN));S$(NOT S): GOTO 200
290 TEXT: HOME:
    IF PEEK(222)<>255 THEN
      VTAB 12: INVERSE: PRINT TAB(16) CHR$(7)"DOS ERROR!" SPC(15): NORMAL:
      FOR X=1 TO 2000:
      NEXT X:
      GOTO 140
```

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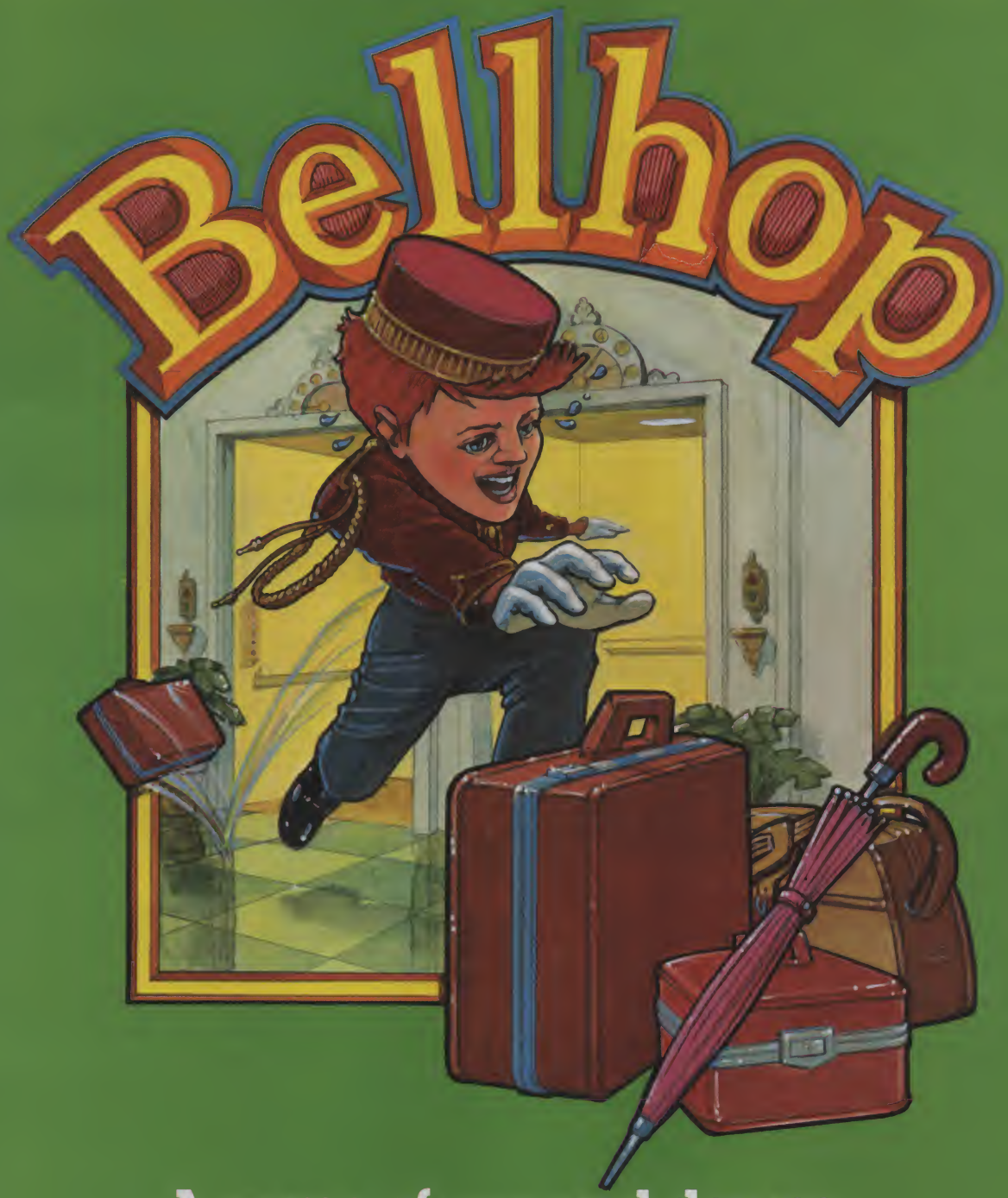

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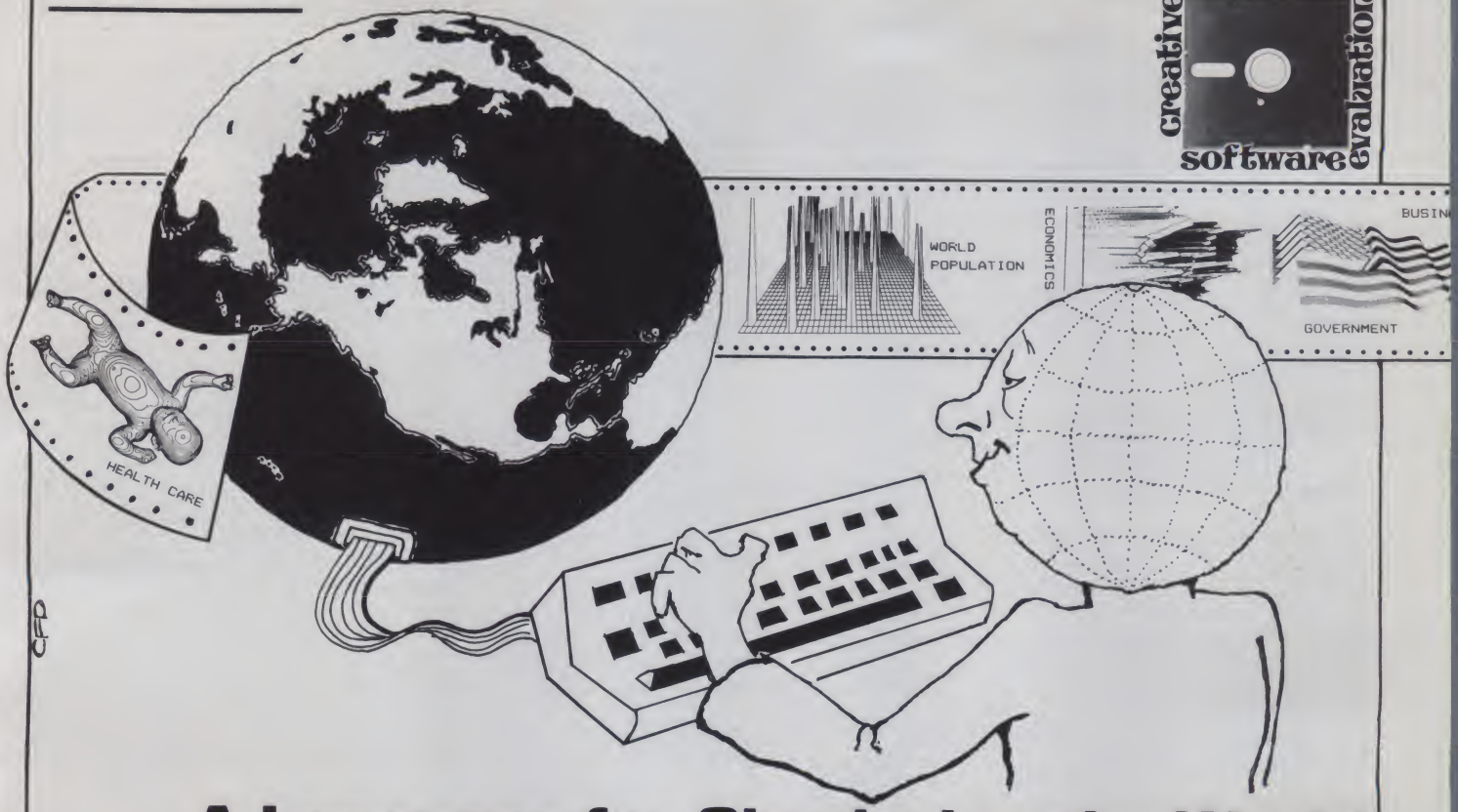

A Language for Simulating the World

creative computing
SOFTWARE PROFILE

Name: Micro-Dynamo
Type: Model-building language
System: Apple II, two disk drives, language or RAM card and Pascal
Format: Disk and 114-page manual
Summary: Builds and runs complex, multi-equation models of business, environment, economics, health care, the world, etc.
Price: $245
Manufacturer:
Addison-Wesley Publishing Company
Jacob Way
Reading, MA 01867

Perhaps the first attempt at building a mathematical model of the economy was Thomas Malthus's observation in *1798 that the population* of the world was growing geometrically while the food supply could grow only arithmetically.

Christopher U. Light, 919 North Michigan Ave, Suite 3008, Chicago, IL 60611.

Christopher U. Light

If the number of people were to double every 25 years (1...2...4...8...16 ...32...) and the amount of food produced were to grow at a linear rate (1... 2...3...4...5...6...) every quarter century, Malthus pointed out, in time there simply wouldn't be enough food to feed all the people. The inevitable result: widespread starvation, misery, poverty, war, famine and pestilence. This conclusion lead Thomas Carlyle to dub economics "the dismal science," a sobriquet it has yet to outgrow.

Malthus's prediction was not fulfilled — at least in the short run — in part because he couldn't foresee the great advances in technology that would happen in the next two centuries. In essence, his model was very incomplete and would remain so until the invention of the computer.

His work, however, was never forgotten. Thoughtful people have long been aware that the world's resources are finite and may someday be used up. A decade ago two events based on this realization shocked the world.

The second of these was the 1973 OPEC embargo on oil and subsequent doubling, tripling and quadrupling of its price. This followed by little more than a year the publication of the first "doomsday" study to use modern model-building and computation techniques.

Sponsored by the Club of Rome and entitled the *Limits to Growth*, this study attempted nothing less than to model mathematically the entire world using who knows how many variables and equations — birth rates, fertility rates, land available for cultivation, industrial output, pollution, capital formation — and the interaction and feedback loops between these variables.

Although the final model reported in the book examined only five major variables, these were actually summary variables produced by submodels and were based on consideration of hundreds of factors. It was a staggering project which required the power of the biggest computers of its day.

The results are well known: no matter how the authors varied their assumptions within reason, each simulation run predicted that, unless mankind could develop conservation measures immediately, sometime in the early to middle part of the 21st

century the world's resources would simply be insufficient to support its ever growing population. The result: poverty, famine, war, misery and a rapid decline in the total population caused by deaths due to these factors.

The technique of forecasting changes in complete systems with variables that impinge upon and interact with each other, is called "system dynamics," and a language called Dynamo for what were then considered giant mainframe computers such as the IBM 360 was developed in 1958 by Alexander Pugh and others working with him.

Later it was made interactive and revised for the mini-computer.

Micro-Dynamo is a rewriting of it in Pascal for the Apple.

Writing and Running the Model

Although the manual for *Micro-Dynamo* is subtitled "System Dynamics Modeling Language," the complete Pascal/Dynamo package is far more than just another language. It contains the essential elements of a word processor and includes many menu-driven prompts that require only one-key responses.

In brief, the steps in writing and running a model that will plot over time four variables in four colors simultaneously on a color monitor or print a plot of 10 variables at a time on a printer are:

1) Hit E, so the command menu will run the editor, and then type in your program.

2) Hit Q so the editor menu will present its save menu.

3) Hit W to write your program on a disk with the name you give it.

4) Hit E to exit the editor.

5) Hit L (for linker) to call the compiler.

6) When prompted, re-enter the name of your file.

7) Wait while your program is compiled and error messages are printed out.

8) Return to the editor, correct the errors if necessary and repeat the above steps, or, if no corrections are needed, simply wait while your program is run and the predicted values of all of your designated variables are first listed numerically and then plotted.

If you hit Reset or Escape at the wrong time, you'll curse a blue streak, but otherwise error-trapping seems just fine.

So that is the system itself — similar to a word processor except that it deals in equations and also runs a program. The language in which you write your program is not especially difficult to learn, but it is neither Basic nor Fortran and has some surprises for programmers familiar with those two.

Dynamo is a very specialized, single purpose language whose only function is to make it easy for a model-builder to enter and run a dynamic model (one in which all variables except constants are mathematical functions of time). While this specialization does, of course, reduce its versatility, it also means that the unexpected occurs less often and the language can be learned quickly.

An experienced Apple user who is familiar with either Basic or Fortran and also with model-building should need only a day or two to grasp both the language and its editor/printer system.

Modelling Malthus

Perhaps the best way to discuss *Micro-Dynamo* as a programming language is with an illustration. Because most of the examples that come with the package are long and complicated (Jay Forrester's World Dynamics model, for example), let's write a little program using Malthus's observations.

Let's assume, as he incorrectly did, that the population of Great Britain is 15 million and that it is doubling every 25 years (which is an annual compound growth rate of about 3%).

Let's assume that food production grows by 5% of its initial amount every year. At the end of 25 years, it will be 125% higher, while the population will have doubled.

Let's also assume that all of the British farmers in 1798 could grow enough food to provide 3000 calories a day for each of the 15 million people, but that each person requires 2000 calories a day. In other words, there is a surplus of food in time zero (1798), but with the population growing exponentially and food production linearly, the annual surpluses will become shortages at some point in the future. Question: in what year will this happen.

To find out, we have written a short program in *Micro-Dynamo* that appears in Listing 1. As you study the program, probably the first thing you will notice is that there are no line numbers. *Micro-Dynamo* does not use line numbers because you can enter the lines in any order and the language will sort them in memory so that they will be in the correct order when the program is run.

The second thing you will note is that there is no asterisk between (DESPOP.K) and (RATE) in line 3. Although *Micro-Dynamo* does recognize the asterisk as a multiplication sign, and requires it if there are no parentheses, it also accepts back to back parentheses as a command to multiply their contents.

In place of line numbers, this language uses the first few columns (up to the first space) to indicate the kind of instructions the line contains. The asterisk in line 1, for example, makes that line the title that will be printed at the head of the graph.

In the second line, L indicates a line defining a difference equation for a *level* (a stock that is constant at a point in time but which changes over time), while R indicates a *rate* (a flow over time that changes the level of the stocks). Think of water flowing into or out of a bucket at some rate per minute but which is at a certain level in the bucket if measured at a given time.

The letter C indicates that the line sets the value of a *constant*, while A stands for *auxiliary* and is used for equations that have the same time period on both sides.

PRINT tells which variables should have their values printed. PLOT does the same thing for a graph. And SPEC sets certain *specifications* including the number of time periods the program is to compute.

Listing 1.

```
*       MALTHUSIAN POPULATION GROWTH
NOTE
L       DESPOP.K=DESPOP.J+(DT)*(NEWPOP.JK)
R       NEWPOP.KL=(DESPOP.K)(RATE)
C       RATE=.03 GROWTH RATE
L       CAL.K=CAL.J+(DT)(.05*ICAL)
C       ICAL=45000
N       CAL=ICAL
A       CALPOP.K=CAL.K/2000
N       DESPOP=15
NOTE       POPULATION IN MILLIONS
A       POP.K=MIN(DESPOP.K,CALPOP.K)
PRINT   DESPOP,CAL,POP
PLOT    DESPOP=D,POP=P(0,300)/CAL=C(40E03,300E03)
SPEC    DT=1/PLTPER=10/PRTPER=10/LENGTH=100
RUN
```

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Letters following a dot are *timescripts*, subscripts indicating time periods. There are only three: J is the previous time period; K the one the program is calculating currently, and L is the next one. Double timescripts (.KL, for example) indicate that that variable doesn't change between those two time periods.

Now study the example in Listing 1. The first L line says that the desired population (that produced by unchecked growth and thus presumably desired by the parents of the children, hence the variable name) in any given year is equal to its value in the previous year plus the new population per time period multiplied by the number of time periods between each computation (DT which is, in this model, one year).

The next line, R, states that next year's new population will be equal to this year's total population times the annual growth rate. The constant line following sets that growth rate at 3% a year; the term "growth rate" that follows is one of the permissible ways of making a remark.

The following line is like the first and states that the total number of calories available to feed the population is the same as last year plus the new production which is 5% of the initial value each year. ICAL sets the initial daily average food production for Great Britain at 45,000 million calories or 3000 per day per capita.

The letter N that begins the next line signifies that the information in the line initializes some variable. In this case CAL — with no subscript — is given its initial value in time period zero.

The auxiliary line that follows determines the population that can be fed if each person requires 2000 calories a day.

Another initializing line sets the beginning population at 15 (in millions), while the line beginning with NOTE is a third way of making a remark.

The next line illustrates one of the logical operators of the language. In this case the actual (or maximum possible) population equals the lower (minimum) of the unchecked population, DESPOP, or the population that can be fed, CALPOP.

The PRINT line says to print values of the unchecked population, the total food available measured in calories per day, and the actual population.

PLOT says to use D when plotting DESPOP on a daisy wheel printer, P for POP and C for CAL and to set the bottom and top scales of the graph at 0 and 300 for the first two and at 40 thousand and 300 thousand for the third.

The specification line sets the basic time interval as one period (one year), but plots and prints points every ten years for a total of 100 years . . . Whew!

When the program is run, *Micro-Dynamo* sorts the equations into a usable order (to get the initial values at the beginning, for example), compiles the program and searches for errors, computes the values of the variables time period by time period, prints them on the screen and finally plots in hi-res color a graph of these values.

The graph for our little Malthusian model is shown in Figure 1. On it the straight line above the other lines is average daily total food available (in thousands of millions of calories) each year for 100 years. The curved line beginning near the origin and disappearing off the graph at the top is unchecked population. Superimposed on this curved line for part of its distance and then branching off to the right below it is actual (or maximum possible) population, which is the lower of the unchecked population or the number of people that could be fed.

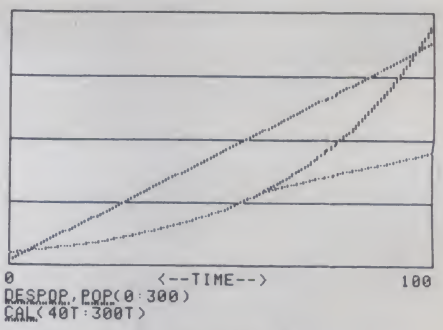

Figure 1. Graph of Malthus's "dismal" model.

After running the program and producing its plots, *Micro-Dynamo* asks if you would like to change any of the parameters and rerun it. We could, for example, set the initial population at 10 million, graph two centuries instead of one and change the scale of the graph — and we could do all of this directly from the keyboard during the rerun phase.

The program would then be run again with the new values but without having to be compiled anew. Only if the structure of the model is changed is it necessary to return to the editor and then recompile to make the alterations.

History Updated

At Addison-Wesley, I had the opportunity to briefly use *Micro-Dynamo*. Having run some of the first articles on Dynamo in the November 1974 and March 1975 issues of *Creative Computing*, I was curious to see how far dynamic modeling had come in the last eight years.

In 1973, Pugh-Roberts Associates released Dynamo, a compile-and-go processor. In the March '75 article, Jay Anderson of Bryn Mawr found that Dynamo was somewhat cumbersome and slow for classroom use. He recommended using a "recipe" for translating System Dynamics models or existing Dynamo programs into Fortran IV. Although it required more programming effort, the result was a program that was more transportable and which ran much faster.

With *Micro-Dynamo* on the Apple, the transportability problem has been largely solved. However, the speed problem has not. Forrester's World Model, admittedly a large model with 249 statements, took 5.2 minutes to load, 4.1 minutes to "reorder" the equations and a few seconds more to display the results.

One particularly unfriendly aspect of the software is that in some places it expects a Return after an input and in other places it doesn't. By itself this would not be horrible except that in certain places a Return is interpreted as no response. For example, to load a model, you should type:

L (no return)
MODEL NAME (Return)

If you type, as I did:

L (Return)
MODEL NAME (Return)

the program assumes that the Return after the L means no model name is to be loaded and it terminates. Yes, terminates. That puts you back into Apple Pascal and you must start over from scratch.

On the bright side, once your model is loaded correctly and the equations reordered, new model conditions (not equations), may be input reasonably easily and executed reasonably quickly. Coupled with the forthcoming book from Addison-Wesley, *Micro-Dynamo* is an excellent system, particularly for educational and scientific environments. — *DHA*

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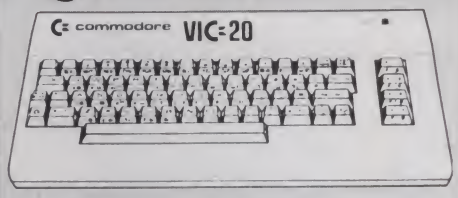

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Our model is obviously incomplete, as was Malthus's version of it. For one thing, it fails to consider the effect on food production of having more labor to cultivate the land. Including this would involve a feedback loop of the sort that *Micro-Dynamo* is explicitly designed to handle.

Other Features

Nor can a simple program like this one illustrate the rest of the features of the language, which include pseudo random numbers distributed either uniformally or normally, sudden shocks to the system, regular cyclical behavior of one or more variables, delays, smoothing (averaging) of a variable and arbitrary relationships between two variables entered by using a table of numbers instead of an equation.

Mathematical operators available are the basic four (+,-,*,/), sin, cos, sqrt, the exponential e and natural logarithm. No operator is available for raising a value to a power; logs must be used instead. Although there is a maximum number of equations *Micro-Dynamo* can handle at once — strictly speaking, a limit on the number of mathematical operators — this number is not given in the instruction manual. The manual does, however, note that about 100 different variables are possible.

Logical operators are limited to greater than, less than, greater than or equal to, and less than or equal to. Because the programmer neither has nor needs control of the order in which the program lines will be run, there are no *gotos*, subroutines, or other branches.

Lastly, *Micro-Dynamo* cannot solve simultaneous equations. It must find a starting point and work sequentially along a time path. If it can't, it stops and prints out the error message SIMULTANEOUS ACTIVE EQUATIONS INVOLVING and then displays the offending equations.

Like all high-level languages, *Micro-Dynamo* has numerous ways to tell the programmer he has made a mistake — 55 of them, in fact, not one of which is "syntax error." Some are reasonably familiar: DIVIDE BY 0, MODEL IS NOT ON DISKETTE, SQRT OF NEGATIVE NUMBER. Others are very specific to the task of the language: BAD LEFT SIDE OF = (left hand side of an equation is incorrect); NOT USED (some variable you included in the program was never actually used in your model, indicating that an equation may have been left out); TOO FEW) also TOO MANY) (when parentheses don't match).

Because this is a compiled language, errors are caught during the compilation stage well before the program is run. When an error is found, the compiler stops, prints the error message and the line it is in, and puts the letter V above the line pointing at the character it thinks is in error. Even though the error may be serious enough to prevent the program from running, you are given an opportunity to quit or to finish compiling to search for more errors. Only after an error-free compilation will the program begin running.

Shortcomings

Unfortunately, as good as *Micro-Dynamo* is — and, unless some hidden bugs come out in time, it should find enthusiastic acceptance among model builders — it does have some drawbacks. Most of these shortcomings stem from the fact that it is a revision of a language that is now almost a quarter of a century old rather than a new package designed specifically to accommodate the abilities and limitations of microcomputers.

Although it has been shined up, its age does peek through. Variable names, for example, are limited to six characters as in Fortran IV, and statement lines can be a maximum of 80 columns long, which is the same number as on the cardboard IBM card that was the only input device available a couple of decades ago.

Even though an Apple monitor displays only 40 columns, statements longer than that continue past the end rather than wrapping around to the next line as in Basic. To see the remainder, you must press CONTROL-A to shift the screen light and left — a pain in the neck.

Although the screen display is an impressive hi-res color graph, printed graphs use characters — a number or letter — for each plot just as they did on the IBM 1401. (You remember that one . . . it was the Model-T of the industry.)

Although you can get a hi-res plot by hitting RESET, then booting DOS from a slave disk (not the system master, which zaps hi-res page one) and using a graphics package to do a screen dump to a printer, it is laborious and erases both *Micro-Dynamo* and your program from memory.

It is unfortunate that the author of the micro version of this language ignored the development of the dot matrix printer and its graphics capabilities in the interval since the mainframe and mini versions were written.

And, perhaps most serious, the *Micro-Dynamo* package itself makes no provision for listing your program so that you can proofread it easily. This didn't matter when you could have it all on a handful of cards that could be listed off-line by any reader/printer, but editing a 200-line program when you can see only 24 lines at a time on the screen is a nightmare, especially when it has no line numbers.

Because the program is saved on the disk as a separate file, Pascal can list it, but the *Micro-Dynamo* instructions don't explain how.

Dynamo, Pascal, and the User

For our *Micro-Dynamo* review, we decided to find a reviewer who was familiar with systems modeling but not with Apple Pascal, the computer environment under which it runs. We felt that this strategy would ensure the best possible "simulation" of a typical *Micro-Dynamo* user.

A few capabilities of the Pascal system that we forgot to tell our reviewer about would have made his job even easier. First, it is possible to print charts on paper exactly as they appear on the screen if you purchase a separate graphic dump program that is compatible with Pascal. Second, most 80-column boards can be used with the system for a fuller display of your model as you work on it.

On the other hand the Pascal system, and the reliance of *Micro-Dynamo* on it can be blamed for some of Mr. Light's problems. The saving and printing of work files, including models, has seldom been adequately explained in print. The authors of *Micro-Dynamo* could have overcome the unfriendliness of Apple Pascal only through great effort. The Pascal system was designed for programmers and many non-programmers find it somewhat confusing. — *MC*

A Bug?

Finally, either the package has a bug or the instruction manual is not entirely clear (and most of the time it is so precise and lucid that it could serve as a model instruction manual for the industry — which is sorely in need of one).

When you wish to leave the editor and run the program you have written, you type Q for quit and then are shown an exit menu. The author of the manual suggests always selecting W to write the program on a disk. This is

fine until you return to the editor from the compiler to correct your errors. When you have finished, pressing W writes the old program back on the disk rather than the corrected one.

Saving the corrected program is laborious. You must type Q for quit, U for update, R to return to the editor, Q to quit again, W to write the updated program to the disk, the name of your program using DYN2: as a prefix instead of the more familiar suffix D2 if you want it sent to drive two and finally E to exit the editor.

Knowledge of the Pascal operating system is not strictly necessary to get *Micro-Dynamo* up and running. Nevertheless, you won't get the most out of it unless you insist that your dealer give you a ten-minute demonstration on the Pascal operating system before you leave his store.

Undoubtedly some of the out-of-date features have been retained to make it easy to convert programs written for mainframe and mini versions of Dynamo into *Micro-Dynamo*. Those familiar with the capabilities of microcomputers but new to dynamic model building may find them a nuisance, but nothing more serious than that.

All in all, it is an exciting package that should receive serious consideration by professional forecasters and model-builders and may even enter the homes of a few Apple owners who like to create doomsday scenarios for parlor games. □

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Many TRS-80 programmers wish to write programs which need a fast execution speed, such as business programs which do lots of sorting and game programs with animated graphics. Some of these programmers learn machine language, but more of them are either intimidated by the complexity of machine language programming or simply do not have the time to delve into learning a new language.

What these people need is a Basic compiler; that is, a program which converts Basic programs into machine language. There are several compilers available for the TRS-80, most of which are expensive, require lots of memory and disk storage, and are complicated and time consuming to use. What has been lacking until recently was a Basic compiler as flexible and simple to use as Level II Basic itself.

Harry McCracken, 47 Carleton Street, Newton, MA 02158.

ZBasic supports quite a few commands and functions beyond those of Level II Basic.

Enter Simutek's *ZBasic 2.2* by Andrew Gariepy. *ZBasic* is the one Basic compiler that offers the speed of machine language, without giving up the many virtues of Basic. It is cheap, as Basic compilers go, runs on a 16K tape or disk system, and is a joy to use.

Anyone with a fair knowledge of Basic can easily put *ZBasic* to good use. It is an interactive compiler; that means that the Basic program and its compiled machine language equivalent are both in memory at the same time, and that you can jump quickly and easily between them. That is the key to both the power and the ease of use of the compiler.

Both tape and disk versions of the package include numerous versions of the compiler; there are separate ones for 16K, 32K, and 48K systems, and versions with and without high-precision math and disk I/O. After you load the appropriate version into the computer, *ZBasic* offers you the option of changing the parameters which allow you to relocate the program, chain programs, and restrict string lengths.

After that, you proceed normally. Write your program and debug it to your heart's content as you would without *ZBasic*; you only need compile your program when you want to execute the machine language version.

Of course, since *ZBasic*, your Basic program, and the compiled program must all be in memory at once, space for your program is limited; about 15K in a 48K disk system, for instance. However, by relocating or chaining programs, you can make programs as big as or bigger than you can under ordinary Basic.

Compiling The Program

Compiling your Basic program is very simple: just hold down the Z, X, and C keys at once, and, if your program has no errors, *ZBasic* will compile it and give you a menu allowing you to run your compiled program, save it, or return to Basic.

If *ZBasic* finds an error in your program, it tells you what and where it is and

returns to Basic so you can fix it. *ZBasic* can't find logic errors in the flow of your program; it just detects syntax errors, and other errors which prevent it from compiling your program properly.

While *ZBasic* can compile most Basic commands and functions, there are a few useful ones it cannot handle. Programs with ON ERROR GOTO statements, for example, must be adapted before they can be compiled. While *ZBasic* lacks several scientific functions such as SIN and TAN, an appendix in the manual shows how to get some of them by calling the TRS-80 ROM.

Some Basic commands work slightly differently in *ZBasic*. INPUT, for instance, does not print a question mark automatically. *ZBasic* is also more picky about syntax than ordinary Basic. All arrays must be DIMed, and complicated string formulas may have to be broken down.

The biggest difference between *ZBasic* and Basic is the way *ZBasic* handles non-integer math. The documentation calls the *ZBasic* system @Math, because you must put an @ before all non-integer math statements. Stranger than that, though, is the requirement that non-integer numbers be in strings. That means that the Basic statement A=B*.25 becomes @A$=B$* ".25" in *ZBasic*. That sounds very odd, but it is easy to get used to. The main problem is that it makes converting programs which use high-precision math into proper *ZBasic* syntax a time consuming task.

ZBasic supports quite a few commands and functions beyond those of Level II Basic. Most of these are equivalents of Z-80 instructions, such as LDIR, and LDDR, which make it possible to split-scroll the screen. One of the nicest new commands is a tone generator, which makes it simple to add sound to any program.

While programs compiled by *ZBasic* are generally not as fast as equivalent code written in assembly language, they are almost always at least ten times faster than their Basic versions. Programs which do not make extensive use of non-integer math and string functions improve their running times even more significantly. In ordinary Basic, SET and RESET graphics are so slow that they aren't often useful. *ZBasic* makes them run so fast that they become a real alternative to character string graphics. Even the fastest sorting methods seem to creep in Level II Basic; *ZBasic* makes them zip.

I like ZBasic so much that I simply load it in before doing any Basic programming.

CMDFILE

The disk version of *ZBasic* includes a utility which is a valuable tool in its own right. CMDFILE, as it is called, is a versatile program which lets you load in machine language files from tape and disk, relocate them, and save them back to tape or disk. This not only allows you to save *ZBasic* programs on disk to tape, but also lets you save any non-protected machine language tape to disk, and vice versa.

On the whole, the documentation is quite good. The bulk of the manual is made up of an alphabetical list of *ZBasic* commands and functions, what they do, and any differences between the way *ZBasic* and ordinary Basic handle them. The section of the manual which describes relocating and chaining programs is especially good; it makes fairly complicated procedures easy to understand.

Another useful chapter is the one which explains how to convert programs so that they satisfy *ZBasic*. The manual also includes several useful subroutines and programs, such as a sorting routine and a primitive pong game.

The documentation for CMDFILE, although well written, is far more technical than the rest of the manual; if you don't understand hexadecimal, you really won't be able to make much use of CMDFILE. One other annoying although nonfatal problem with my copy of the manual is that several pages are in the wrong places. I don't know if that is the case with all copies of the manual or just mine.

Anyone who is writing a program in Basic with hopes of selling it to one of the software publishers should think very seriously about compiling it with *ZBasic* before submitting it. The publishers of some other compilers require that you pay them a percentage of any royalties you earn from programs compiled with their compiler. All Simutek requires is a credit line and copyright notice at the start of the program and in the documentation. That is a small request indeed, considering that *ZBasic* can increase the sales potential of a Basic program dramatically.

If you are a Basic programmer who is dissatisfied with the speed of Basic (I've never met one who wasn't) the price of a tape or disk copy of *ZBasic* is well justified by the speed and power you gain.

I like *ZBasic* so much that I simply load it in before doing any Basic programming; that makes it one of the few programs I use almost every day. To my mind, *ZBasic 2.2* is as big an improvement over Level II as Level II is over Level I. □

Bit Pit

Chas Andres

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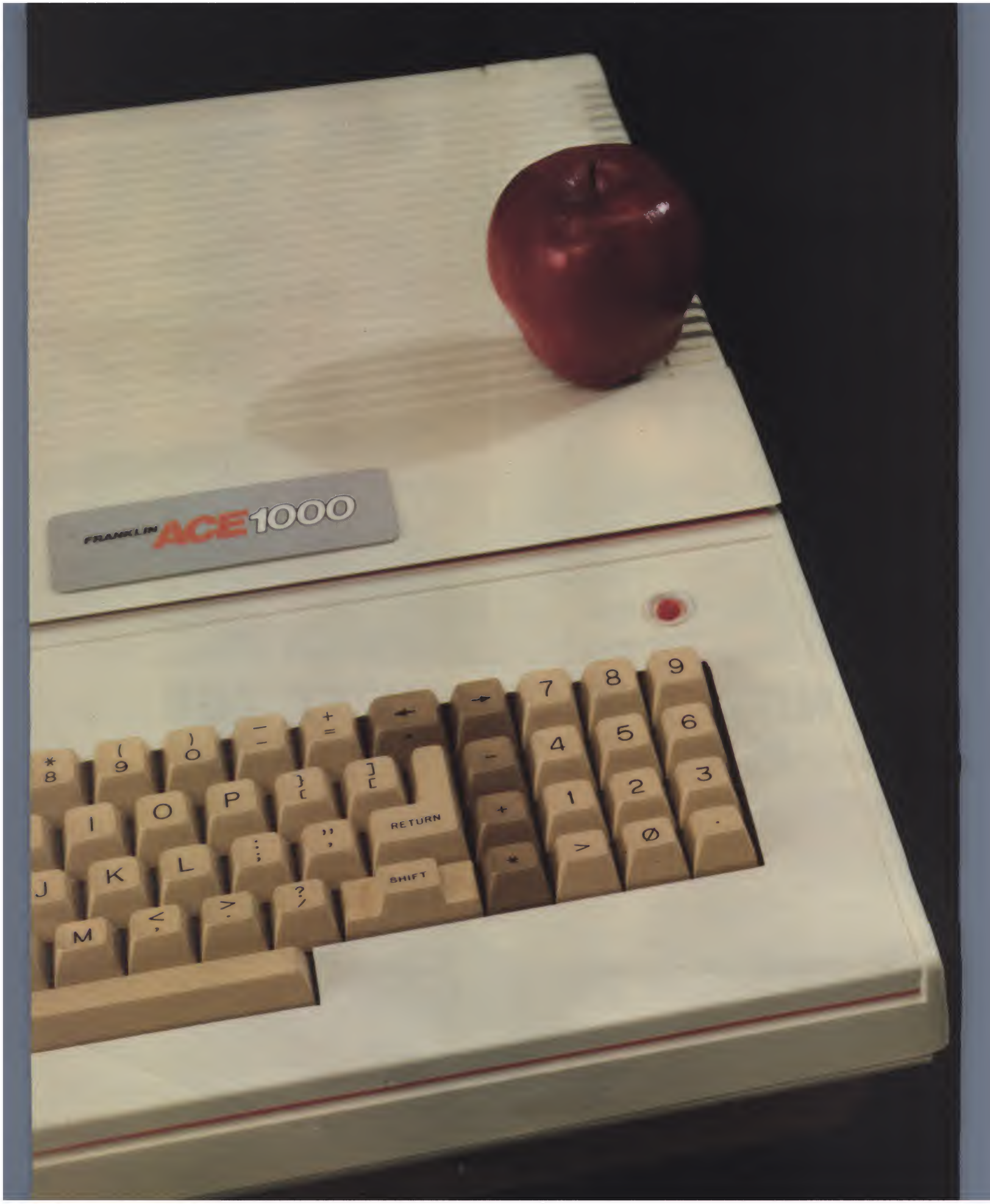
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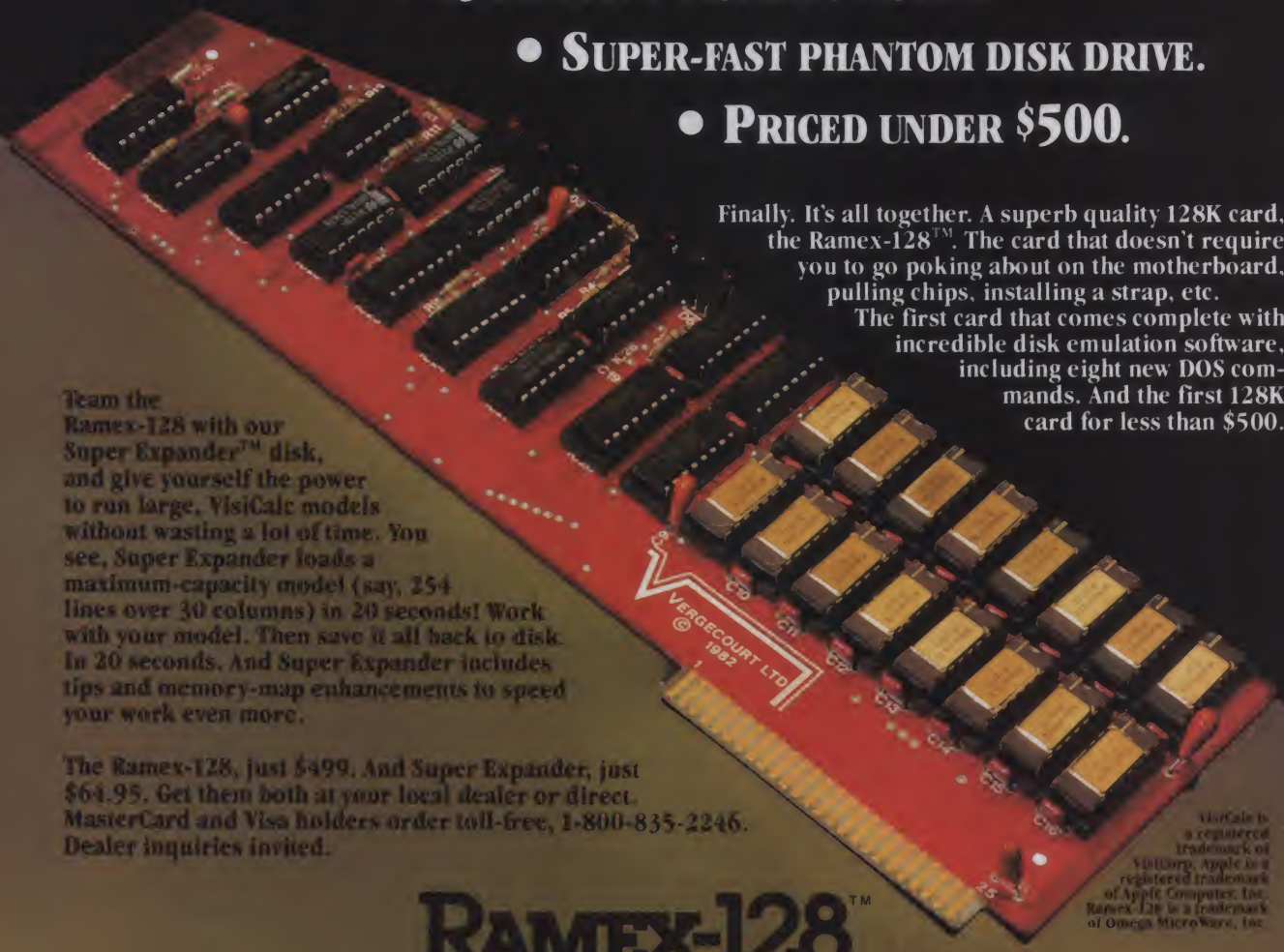

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Forth For The TRS-80

Anthony T. Scarpelli

If you are interested in one of the most powerful computer languages ever invented, then you will be interested in this review of Forth.

Forth was created in 1969 by Charles H. Moore at the National Radio Astronomy Observatory in Charlottesville, VA. It has grown into a language that not only controls the radio telescopes of that observatory, but is used at other observatories around the country. It is also one of the better application languages around because of the ease and speed with which programs can be written in it.

When I became interested in Forth, I didn't want to spend a great deal of money just to try it out, so I invested in the public domain assembly language source code of the language which is offered by the Forth Interest Group for less than $20. That version is meant to be implemented on an 8080 microprocessor based machine, and is not easily converted to a Z80 based microcomputer.

By far the easiest way to try Forth is to purchase a version designed to run on a Z80 computer.

The version I now have is MMSForth, which costs $129.95 for the disk-based version 2.0 from Miller Microcomputer Services.

Getting Started

The first thing you notice when you open the package is the loose-leaf, three-ring binder containing 135 pages of information on Forth: how to get it running, how to program with it, and some examples of simple programs. When you send in your license agreement, you receive another 67 pages which contain a memory map, the Forth glossary, 8080 assembler tables, and several other tables and lists.

Anthony T. Scarpelli, 98 Foxcroft Dr., Scarborough, ME 04074.

It takes several hours to read through the manual, but to get started you need read only the preface and the first appendix.

The first appendix tells how to boot the system disk. What appears after the boot is the copyright information, your serial number, a copyright message, and the address of MMS. A few seconds later the directory listing the options you have available appears. You need not choose any of them, though, the boot loads the Forth language and is ready to go.

This directory is called the Utilities menu, and allows you to choose from the following:

FORMAT allows you to format a diskette.

BACKUP allows you to back up the system or any Forth diskette.

COPIES allows you to copy a range of blocks (a block is 1024 bytes of information).

SEARCH allows you to search for occurrences of words.

TRANSLATE allows you to translate from the older version 1.9 to the present version.

ALLCAPS allows you to change lowercase letters in some of the blocks to uppercase if your system doesn't support uppercase.

CUSTOMIZE allows you to configure the system for your own TRS-80.

EXTENSIONS displays the system options available.

PROGRAMS displays the programs that are available on the other diskette.

The extensions include: DBL-PREC (double-precision numbers), ARRAYS (one and two dimensions), STRINGS (similar to Level II strings), RANDOM (a random number generator), GRAPHICS (the TRS-80 graphics), SCREEN-PRINT (prints the screen to your printer including graphics characters), CASSETTE (tape routines), CLOCK (time and date routines), and TOOLKIT (various other handy routines).

The power of Forth comes from its ability to create new words, and to create words that define other words. When you use a word, Forth executes it as long as it is in the dictionary, and as long as any parameters the word may need precede it.

This version of Forth includes about 200 words with which you can create more words. One of the ways to create a word is with a colon definition. For example, if I write:

: TEST word word word etc. ;

I have defined a word called TEST using several previously defined words. The colon precedes the new word, and the semicolon ends the definition. This process continues until an entire routine or even a program can be called by just one word.

All of the utilities, extensions, and programs in MMSForth are words that have been previously defined, words that are made up of the core words, and core words that eventually become machine language routines.

Features

Let us now consider some of the features that make this version of Forth a very good buy and a very handy development system.

MMSForth will run on a 16K machine with only one disk drive. With 32K or more, however, there is more room for words and programs. Backing up a diskette can be done on just one drive, so a

minimum system is all that is needed to use the language. It will also support multiple drive systems, and a version for the Model III is available.

One of the nice things about MMS-Forth is that many of the features of Level II Basic have been incorporated as extensions. Strings and graphics use similar words, and are used much like their Basic counterparts. The difference is that the execution speed of Forth is nearly as fast as assembly language, so graphics and string manipulation are much faster.

Another feature is that the screen-print routine will print the TRS-80 graphics if your printer is capable of handling them. The printer driver can be the regular ROM routine or a custom driver that can be changed to fit your system. An extended driver is available with page-formatting features.

creative computing
SOFTWARE PROFILE

Name: MMSForth

Type: Language and programming environment

System: TRS-80 Model I, III 16K, IBM PC 32K

Format: Disk

Language: Machine

Summary: Good value

Price: TRS-80 version $129.95, IBM version $249.95

Manufacturer:
Miller Microcomputer Services
61 Lake Shore Rd.
Natick, MA 01760

Programs

Some of the programs included on the second disk show Forth at its best. The SORT program demonstrates differences in speeds between different types of sorts. To show, for example, how slow an insertion sort is, this program loads the screen with a group of random characters, then sorts them. It does the same for the selection and Shell sorts, the quicksort, and a quicksort with assembly partition. It is fun to watch, and a good way to show off your system.

The game of Life is an old favorite. Programmed in Basic, the game takes a long time to go through a generation, but this Forth version is nearly as fast as an assembly language program.

One of the handy things you can do with Forth is to put assembly language mnemonics right into the definitions. Or you can create "code" words of just assembly language mnemonics. This version of Forth contains an 8080 assembler. When the loops of Life are converted to assembly language routines, the speed of a generation is extremely fast—much less than a second.

To start you off, a few patterns are available to initialize the Life generations. With the doodle routine, you can draw your own patterns.

Another game on the disk, BREAK-FORTH, demonstrates how a high level language can be used to write a fast action, real-time version of a popular game.

CHECKBOOK is an example of a business program written in Forth. The source code for the program is provided and explained word by word.

Using some of the standard Forth editor commands, and some of its own, NOTE-PAD allows you to write one page of text.

The Editor

The standard screen editor provided with the system is one of the best I have used. By using the CLEAR key, and the SHIFT and CLEAR keys together, you can delete, insert, and move characters, lines and whole screens of information. The arrow keys move the cursor around the screen with ease.

Forth is written in blocks of 1024 characters which comprise one screen of information (64 characters by 16 lines). Writing Forth programs involves the editing of these screens. Once a block is edited, it is saved in one of the two block buffers so another block can be edited. When a third block is called up, the first block is automatically saved on disk. When you finish writing the program, the word FLUSH saves the remaining blocks to disk.

Documentation

I am a firm believer in good documentation which provides as much information about a program as possible. MMS-Forth does a pretty good job of it, but doesn't go all the way. If you were to buy a Basic interpreter, you can be quite sure you wouldn't get the source code for it. With MMSForth you receive the source code for the entire system disk except for the first 13 blocks. You must list it yourself, but it is there. You also get the source code for the program disk.

The first 13 blocks contain the core words and assembly language routines as well as the disk I/O. The blocks which are provided allow you to see high level Forth programming, and when you become good at Forth, you can modify the code to improve upon or customize it for your own purposes. A total of 128 blocks of source code is a great deal to understand and change, but at least it is there, and I commend MMS for providing it.

If you have heard anything about standardization, it is probably that everyone would like it, but little is being done about it. There are currently four languages that have been standardized. but Forth is not yet one of them. However, thanks to a great deal of effort on the part of people who want to see Forth standardized, the Forth-79 Standard has come into existence.

MMSForth 2.0 contains the words published in this standard. This means that source code created on the TRS-80 can be transported to any other Forth machine and vice versa. That is the theory, anyway. I commend MMS for going along with the standard, and hope that in the future we TRS-80 owners will be able to talk to an Apple or IBM owner as easily as to another TRS-80 owner.

I have read everything available on Forth, and I can say that, except for one book, learning Forth from the available information is like learning Chinese from a dictionary. I thank MMS for providing a great deal of information on Forth, but Forth is an entire language, and you cannot learn it simply by reading the documentation normally provided with the system. You must go to other sources, and you must sit at the keyboard and work with the language.

Forth was not an easy language for me to learn. All of the manuals I have read started out with the easy things, but had a tendency to stop. The more difficult concepts, the use of assembly language, the extensibility of Forth, the best way to program in Forth, and good programming techniques, just were not there. I had to struggle with words that were defined, words that were not clearly explained, and words that were not explained at all.

MMS provides you with enough to start out, but you must purchase and study some of the other books and manuals available before you will become good at Forth. Luckily, one of the best books, *Starting Forth* by Leo Brodie (Prentice-Hall, 1981), is also sold by MMS. I recommend purchasing this book along with this program.

Although I have been very pleased with MMSForth, I have two real complaints about it. The first is that looking up unfamiliar information is very difficult. There is a table of contents, but it is too broad to be of much help.

My second complaint is that occasionally some aspect of what I wanted to know was not explained in sufficient detail for a beginner. An index would be very handy, and I understand that one is being compiled. So there is hope. Whenever I ran into a real problem, a quick call to Miller Microcomputing got me an answer to it.

Summary

My overall recommendation is to buy this program if you want to try Forth. It is definitely a good value. □

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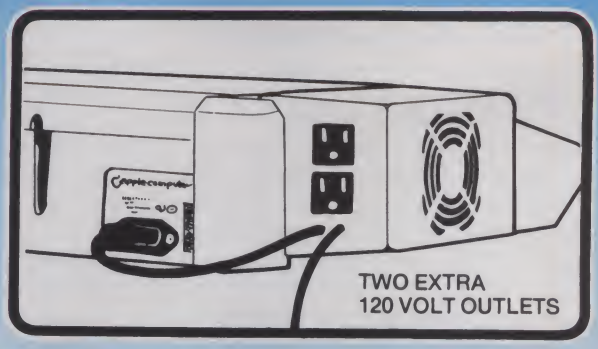

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Pascal For CP/M Systems

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SOFTWARE PROFILE

Name: JRT Pascal 2.1
Type: Language
System: CP/M
Format: 8 inch single density disk
Language: Machine
Summary: Tremendous value for the price
Price: $29.95
Manufacturer:
JRT Systems, Inc.
Box 22365
San Francisco, CA 94122

Roger Edelson

While the $29.95 price of JRT Pascal may be the first feature which attracts attention, the virtues of the compiler go far beyond this reasonable price. For starters, the floating-point operations are performed in 14-figure BCD format which allows calculations to range from 10^{-64} to 10^{+63} (a range of 128 magnitudes). Other CP/M Pascal compiler implementations offer only seven digit precision with a dynamic range of 10^{36}. With 14-digit precision, JRT Pascal is suitable for both business and scientific applications, and as the data are stored in BCD format there are no errors when converting from internal storage to print format.

The second most noticeable features of JRT Pascal are its ease of use and the reasonable size of the resident compiler. JRT Systems has solved the problem of fitting the compiler and CP/M operating into a 52K memory space with enough room left over to produce useful results.

One well known and highly respected Pascal compiler simply will not run under CP/M on my NorthStar Horizon which has only 56K of useable memory available below the Disk Boot PROM.

The JRT compiler occupies approximately 20K of memory and allows parts of the program to be compiled separately into "external modules." These external modules are then linked together at run-time under the EXECutive interpreter. For this reason, it is not necessary to run a huge compiler when linking various external procedures, and it is therefore possible to run large, useful programs.

The use of external procedures by JRT Pascal does not require any extra programming effort as the "virtual storage manager" handles everything automatically. To make use of externals even easier, they do not even have to be on the same, or logged-in disk; the EXEC program will search all available drives automatically. As initially configured, the EXEC interpreter will search drive A first, followed by drive B. A customization program is provided, however, which allows the user to define the search sequence as well as the drives to be searched.

Dynamic Memory Management

The EXEC program is loaded starting at the CP/M standard location of 100H and then loads the referenced Pascal program just above it. Both programs are fixed in size—the EXEC.COM file as defined in the release (about 20K) and the Pascal Program Module, by the size of the compiled .INT file.

The data stack (which contains all static variables, as created by the VAR declarations, and the parameters and procedure activation blocks) is variable in size and grows upward from the high end of the Pascal program.

Dynamic storage, which contains the I/O buffers, the dynamic variables, the file control blocks, and the external procedures, grows downward from the top of available storage. If there is limited available memory area, a collision between the data stack and the dynamic storage area is possible.

To avoid run time errors, the EXEC virtual storage manager attempts to maintain a minimum of 64-byte buffer between the two areas. If the memory space between the two variable areas falls below this value, the run-time system takes several different actions to restore this cushion. In the first stage, the least-recently-used external procedure is deleted, and then if necessary, the dynamic storage area is compressed.

The use of separately compiled external procedures coupled with the dynamic memory management system allows the size of the complete Pascal program to be practically unlimited. The external procedures are loaded into the dynamic storage area when first referenced by the main program, a procedure which is transparent to the user.

Unlike program chains or overlays, the external procedures remain in memory until an impending memory collision is detected. When this condition occurs, the EXEC program automatically unloads the least-recently-used external procedure, but to minimize the time required to

Roger Edelson, 3270 Granville Ave., Los Angeles, CA 90066.

reload the procedure when again required, the control blocks associated with the procedures are maintained. This procedure makes the actual storage capacity of the computer seem considerably larger than would be inferred from the actual memory size.

Another dynamic allocation feature available with JRT Pascal is dynamic strings. Similar to the string size dynamic structure found in MBasic, the string size is dynamically allocated. This means that strings do not have to be padded to fill the predefined size—a feature which makes string operation easy and virtually transparent.

Further, in JRT Pascal strings may be of any length up to 65K bytes, if required; the actual maximum size will be much smaller, as determined by available memory.

Debugging

JRT Pascal provides 75 specific English text error messages of between one and four lines, plus ten general run-time messages which are identified and defined in the manual.

To assist in debugging, significant additional information is provided when the EXEC program exits on an error. After the appropriate error message has been displayed, the current line number and last entered procedure name are provided in most cases.

A system status display containing useful information about the state of the run-time system at the time of error detection is created. The system status display presents nine fields of information indicating the address of the error, the current usage information for the address field. A typical system status display is presented in Figure 1, along with a simplified memory storage map.

JRT Pascal supports both sequential file processing and random file processing.

Also presented in the system status display is a count of the number of times storage has been auto-compressed (compr:), and a count of the number of external procedures which have been purged (purge:). The address given as prog: is the starting address of the main Pascal program; the HEX number at size: gives the program size, which when added to prog: gives base:—the bottom of the data stack.

The two values low: and tos: provide information detailing the amount of available memory which lies between these two dynamically allocated storage areas. It is this space (low:-tos:) which the dynamic storage allocator attempts to maintain at a value greater than 64 bytes.

JRT Pascal supports both sequential file processing and random file processing. Sequential file processing is usually faster than using random files because the disk operations can be organized sequentially, minimizing disk access.

JRT Pascal also allows improved disk use by allowing the user to define the size of the buffer which serves as a temporary storage area for data written to or read from the disk.

Often, it is not possible to prearrange the order in which data files will be required by the program; in these cases the slower random file processing must be used. In version 2.0 of JRT Pascal, random files were limited to 65K. Version 2.1 has removed this limit, allowing file sizes of 8Mb—the CP/M maximum.

JRT Pascal allows full random access to data by the Relative Byte Address (RBA) which gives the location of the data item within the file. This technique allows great flexibility, as the files may be of random length rather than forcing all files to be the size of the largest. A sample program illustrating random access to a file containing sales information is shown in Listing 1; the records are located by department number.

Figure 1. Sample system status display memory allocation.

```
System status display

   addr :54F5   prog :3BA7   size :4815
   base :83BC   cur  :89AC   tos  :8A33
   low  :A8B9   compr:0002   purge:0000

                 ------------------
                 I     CP/M         I
                 I----------------I
                 I  dynamic         I
                 I  storage         I
        low---> I----------------I
                 I                  I
                 I  unused          I
                 I                  I
        tos---> I----------------I
                 I                  I
        cur---> I  data stack      I
                 I                  I
        base--> I----------------I
                 I                  I
                 I  Pascal code     I <--addr (of error)
                 I                  I
        prog--> I----------------I
                 I                  I
                 I  EXEC run-time   I
                 I  system          I
        100h--> I----------------I
                 I  reserved area   I
                 ------------------
```

Listing 1. Sample random file program.

```
PROGRAM INQUIRY;

LABEL 10;

TYPE
DEPT_RECORD = RECORD
        INVENTORY        : REAL;
        MTD_SALES        : REAL;
        YTD_SALES        : REAL;
        DISCOUNT         : REAL;
        END;

VAR
INPUT_AREA : DEPT_RECORD;
DEPT_FILE  : FILE OF DEPT_RECORD;
DEPT       : INTEGER;

BEGIN (* INQUIRY *)
OPEN( DEPT_FILE, 'C:DEPTDATA.RND', BINARY );

REPEAT
  WRITE('Enter dept number : ');
  READLN( DEPT );
  IF DEPT = 999 THEN GOTO 10;  (* EXIT *)
  READ( DEPT_FILE, RRN, DEPT;
        INPUT_AREA );
  WRITELN;
  WRITELN('dept',DEPT,
        '   inv',INPUT_AREA.INVENTORY:9:2,
        '   disc',INPUT_AREA.DISCOUNT:9:2);
  WRITELN('   MTD sales',MTD_SALES:9:2,
        '   YTD sales',YTD_SALES:9:2);
  WRITELN;
10: (* EXIT LABEL *)
UNTIL DEPT = 999;

CLOSE( DEPT_FILE );
END (* INQUIRY *).
```

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As mentioned, the use of separately compiled external procedures eases the size problems associated both with the compiler and the run-time program and adds no tedious details to the programmer's task. The external procedures are auto-loaded as required by the run-time program, EXC. The external procedures and functions must be declared in the main programs which reference them, and these procedure declarations and parameter lists must be consistent among different files. This is very important as the compiler will not check these declarations and validate the consistency.

The external procedures produced under the JRT compiler can access all the global variables in the main program—variables which have been declared before any procedure or function declarations.

In the example of Listing 1, CUSTOMER-LIST is a global variable. To access global variables or files, their declarations must be inserted in the external procedure file following the reserved word EXTERN, and preceding the procedure header. These declarations must be identical to the global declarations in the main program, though additional constants and type identifiers may also be present in this area.

As distinct from the original implementation of Pascal, the JRT version supports extensive capability for Input/Output control.

While the structure of a JRT Pascal external procedure is similar to a standard "internal" procedure in format, there are two minor differences. First, the PROCEDURE statement must be preceded by the word EXTERN, and second, the END statement must be followed by the standard semicolon and then a period, to signify the end of the compile unit.

Activan

JRT Pascal provides Activan, an exclusive external procedure, which monitors the execution of a Pascal program. Activan monitors the line numbers as used by the compiled program and keeps a line counter record for all numbers within the specified range. Both the range of line numbers to be monitored and their spacing may be specified, and can be changed as the program is executing.

The output of Activan is a graph showing the amount of time spent executing each portion of the program—an invaluable aid in tuning and optimizing program operation. All that is required to use the Activan facility is to compile a program with the %LTRACE directive or to set the $L switch on; the program is then run by specifying the $A switch at run-time (i.e., EXEC TESTPGM $A).

As distinct from the original implementation of Pascal, the JRT version supports extensive capability for Input/Output control. It is possible to make use of a built-in procedure, "CALL, to make direct calls to the CP/M operating system, BIOS (user dependent Basic Input/Output System), or any machine language code present in the main storage.

As a complement to this built-in procedure, JRT Pascal also provides a special purpose assembler which translates assembly code into relocatable external procedure modules. These external procedures are then automatically loaded as required at run-time just as any other external procedure.

Additionally, if a Microsoft format assembler (RMAC, or Macro-80) is available, then the CONVERT utility converts REL files produced by these assemblers into .INT format files. These files may then be accessed as external procedures. These features are not found in the "standard" implementations of Pascal, and therefore JRT Pascal is not portable to the extent that such functions are used.

As most Pascal implementations have evolved away from the original UCSD version, this lack of portability is no real handicap, and the additional features are very worthwhile.

Documentation

The 125-page manual is well written and complete. There are sufficient examples of all the functions that even an inexperienced user can readily make use of the advanced features. The Table of Contents is so complete that the lack of an Index is hardly noticed.

Initially, JRT Pascal was available only as a CP/M compatible program on 8" single density (IBM 3740 format) disks, but JRT Systems has informed me that the latest version is available in many popular 5 1/4" formats. Through an arrangement with Allenbach Industries, JRT Pascal may now be obtained in NorthStar, Osborne, Apple CP/M, Super Brain, and Heath soft-sector formats.

While "there is no such thing as a free lunch," JRT Pascal at $29.95 (which includes postage) certainly allows the user to experience champagne and caviar at cafeteria prices. □

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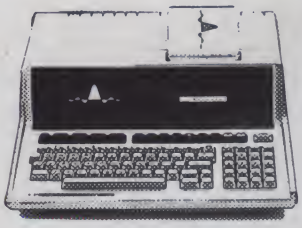

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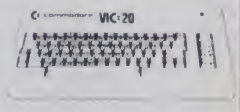

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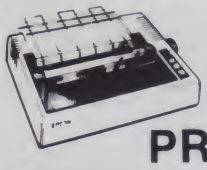

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Programming in Pascal

Greg Greene

So, you say you are fed up with the different dialects of Basic. You have had enough of its slow execution times, of having to fill up memory space with REM statements so you won't become tangled in the variable jungle. Your GOTO statements sometimes lead off to Fantasy Island and your GOSUB and FOR... NEXTs are for the birds. In short, your program structure is about as solid as the kids' first tree house and you want out of the whole mess.

After reading all the reviews and articles you have decided to step up to structured programming and take part in the new wave that the ads tell you is sweeping the world of micros and minis. You have decided to hop on board the Pascal wagon and find a better way of doing things.

Zipping down to the local computer book store you return with a bushelful of manuals and texts on Pascal and settle down to learn. However, it has been a long time since graduation, and you can't seem to pick up the information from the printed page as easily as you once did.

You need help. You need a teacher. You need an audio-visual presentation of the fundamentals of the language. Well friend, here it is.

Greg Greene, 207-885 Craigflower Rd., Victoria, B.C. Canada, V9A 2X4.

Just such a course is now available from the Heath/Zenith folks, at your local Heathkit store or Heath/Zenith Data Systems dealer. The course is entitled, "Programming in Pascal, an individual learning course." It consists of a 510-page manual and five cassette tapes. The tapes, of course, provide the audio and the manual the visual part of the instruction.

Of special interest is the way the material is presented. The manual consists of several lessons which break the material into easily digested parts. The manual is *not* just a printed version of the material on the tape. The authors have used the instructional techniques that work best on paper in the manual, and those that work best in audio on tape.

The pages of the manual do not consist of mere words; they incorporate overhead projections and flip charts. That is not to say that the actual film is presented. It isn't, but the page looks as the film would when projected. In fact, I believe that you could reproduce the page for projection purposes if you desired. In any case the effect is the same as sitting in a classroom.

The audio tapes are keyed to the text. You are told which tape to use, and when to turn it on. The voices on the tape are both pleasant and well modulated—one male and one female. I defy you to fall asleep while listening to it. Both speakers are very good.

The course presents standard Jensen and Wirth Pascal. It is divided into 10 modules. The tapes are approximately 30 minutes in length, and the lessons take about two hours each to complete.

A final examination is provided, and at the conclusion of the course you send it to Heath to be marked. Credits can be assigned upon successful completion of the course. These are Continuing Education Credits, and I believe they are recognized by some, if not all, colleges in Michigan. Now let's take a look at what the course offers.

Module One is an introduction to the course and describes the structure of a simple Pascal program. Constants and variables are defined along with expressions. Input and Output statements are examined at the conclusion of this module. You learn the difference between write and writeln, for example.

At the beginning of the module, the goals are clearly set forth, along with a list of the new words in that lesson. At the

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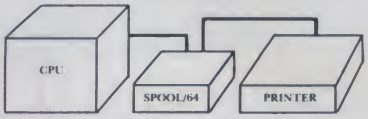

computer, accepts input from parallel centronics cables (serial RS-232 available soon), and its user programming feature allows you to download your own programs so SPOOL/64 can handle sophisticated print routines. And SPOOL/64, used with your software spooler, can give you the highest performance spooling available.

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conclusion of the module there are self-tests and exercises.

If you have a Pascal language installed on your computer, you can follow along with the course using it. Because of the different types of editors available for the different systems, you will need to familiarize yourself with the one that works on your system, before trying to write a program.

Module Two introduces the concepts of procedures and functions, and describes the rules of scope as defined for standard Pascal. This lets you visualize the use of global and local variables and constants. It is one of the great strengths of Pascal that variable and constant values need not be passed through the whole program, unless desired. As with all the modules, self-tests and exercises enable you to determine if you have mastered the material.

Module Three introduces the IF... THEN...ELSE statement, CASE statement, and Boolean objects. These are the decision making statements of Pascal. They are very similar to Basic and should present no difficulty to anyone with a knowledge of Basic, or, indeed, anyone who is learning Pascal as his first language. The authors make good use of flow charts in this module, and thus encourage their students to use them in their own programming.

Module Four is entitled "Looping" and presents the three types of loops: REPEAT...UNTIL, WHILE...DO, and the familiar FOR...NEXT. Although similar, these three loops have definite jobs and different ways of testing for the end of the loop.

Module Five defines the various data types available in Pascal. Pascal provides for many different types of data as a function of the language, and even allows you to define your own. The language also has pre-defined functions that allow for quick and easy manipulation of the data.

Frame 2

LEARNING OBJECTIVES

GOALS. When you complete this module, you will be able to:

1. Identify and write procedures with parameters that:
   A. Are complete and correct, and
   B. Perform the desired tasks.
2. Identify different parameter-passing mechanisms.
3. Apply scoping rules to determine how and what objectives are handled inside and outside of a procedure.
4. Choose the right parameter type for a given problem solution.
5. Use arrays as parameters correctly.
6. Understand and use recursion.

VOCABULARY

Parameter, value parameter, variable parameter, parameter list, passing a parameter, arrays as parameters, packed arrays, recursion, recursive call, formatting instructions, functions as parameters, procedures as parameters, specther, **var**, **function**, **procedure**, parameter specifications.

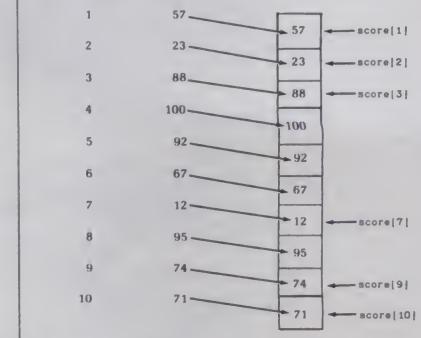
Restart the tape.

Frame 6

FROM DATA ITEMS TO ARRAY

Data items — **Put in array called score**

student number	test score
1	57
2	23
3	88
4	100
5	92
6	67
7	12
8	95
9	74
10	71



Exercises

What is contained in

1. score[8] ?
2. score[6] ?
3. score[1] ?

Check your answers in "Back-Up 3."

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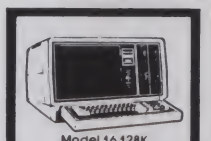
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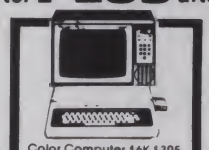
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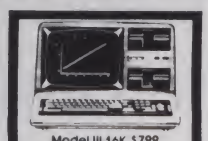
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Module Six deals with arrays. Basic provides, in most of its implementations, for extensive manipulation of arrays in much the same manner. The manner of declaring them is different, but accessing a given element is the same as in most Basics. If you know how to use the arrays in Microsoft Basic, this section should seem familiar to you.

Module Seven explains how values are passed to procedures and recovered. It is similar to the way in which defined functions are used in Basic. The use of recursive procedures is also explained here. Recursion is a very powerful programming tool, and this part of the course will help you learn to use it to good advantage.

Module Eight introduces records and sets. The visualization of sets was the most difficult part of the course for me to handle. I guess I couldn't believe that so much could be done with so little effort. By manipulating a single record, all the fields associated with it can also be manipulated. I don't know of any similar construction in Basic other than the INSTRING function. I plan to do a great deal of experimentation on this concept alone.

Module Nine discusses pointers. The use of pointers in Pascal allows the rapid access of data from several storage areas. You can create trees, stacks, queues and linked lists with ease. There are several predefined functions to help you in Pascal.

The use of pointers is another area that wasn't easy for me. I don't think I would have been able to master it at all just by reading. The tape is what made it clear in the end.

Module Ten presents files. Pascal, in its standard implementation, allows the use of only sequential files. This is not surprising since at the time it was written, the prevalent storage medium was magnetic tape. Thus, the use of pre-defined procedures such as REWRITE reflect the naming conventions of an earlier age.

This chapter deals only with the use of sequential files as implemented in standard Pascal. UCSD Pascal allows the implementation of random access, and the student is referred to several texts at the end of the chapter. After completing the course, he should be able to pick up any book on the implementation of UCSD Pascal and have little difficulty with it.

Programming in Pascal is written and presented as I wish my high school courses had been. It pays attention to instructional techniques, and while there may be some people who will not be able to absorb Pascal from this course, I think they are probably few and far between.

I think the course is good value for the $159 price, especially given Heath's money back guarantee. I didn't check their guarantee provision, because I had no reason to return it; it worked for me.

Heath/Zenith, Benton Harbor, MI 49022. □

SELF-TEST

Frame 22

Mark items 1 through 6 True or False.

1. _____ Program names, procedure names, and function names are Pascal identifiers.
2. _____ Declarations in a Pascal program can appear in any order.
3. _____ An identifier may be declared several times in the same block.
4. _____ An identifier may be used only within the block where it is declared.
5. _____ The scope of an identifier is determined by the smallest block enclosing its declaration statement.
6. _____ A program must have global variables if it is to pass data from one procedure to another.
7. Pascal has no special operator for performing exponentiation. How would you write a subprogram that would do this?
8. Identify what may be wrong with each one of the following program segments:

```
A. FUNCTION HALF:
     VAR X : REAL.
     BEGIN
       HALF := X/2
     END;

B. PROCEDURE EVER.
     BEGIN
       WRITELN.
       EVER
     END;
```

Check your answers in "Back-Up 13."

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CIRCLE 131 ON READER SERVICE CARD

Alternative Languages for the Color Computer

Scott L. Norman

The Radio Shack TRS-80 Color Computer is something of a sleeper among personal computers. Although the manufacturer has promoted it primarily as a games machine and household computer, devotees know it to be much more powerful and flexible than this would indicate.

The Motorola 6809 represents just about the last word in 8-bit microprocessor technology, for example, and Extended Color Basic is a potent, graphics-oriented language with all of the experience and expertise of Microsoft behind it.

Basic isn't the whole world, though. Its lack of speed is a problem for every writer of games or simulation programs, and its syntax encourages the kind of unstructured programming against which computer scientists rebel. Fortunately, software developers have begun to produce a variety of alternative languages from which Color Computer owners may choose.

In this review I will describe the ones with which I am familiar. I am almost certain to miss one or more, if only because of the time lapse between the submission and publication of this piece. (*See the review of EDTASM+ in this issue*—Ed.) Still, I hope that at least some of this material will be news to you.

First, a few words of warning. Space (and time) limitations restrict the amount of detail which I can present on any single language and while I hope to spark some interest among Color Computer users who are not computer science pros, this article is a long way from being a tutorial.

It will probably become obvious that my interest lies in high level languages, although I will also try to summarize the assemblers available for the Color Computer.

Where speed is important, such as in real-time handling of I/O or graphics, assembly language has a lot going for it.

Finally, I should point out that most of the new languages for the Color Computer actually available at the time this is being written are fairly restricted subsets of their parent languages.

Since Extended Color Basic is a powerful, mature dialect, why should one bother with the alternatives at all?

I can think of two reasons. First, programming languages can be intrinsically interesting. There is probably no better way to learn about a new language than to set your hands on your own copy of a compiler, interpreter, or whatever, and begin to experiment.

The second reason is a little more nebulous, but it goes something like this. The languages we use to describe problems influence the way we think about the problems themselves, and may even affect the solutions we are able to find. This holds for programming languages as well as for other formal systems. Therefore having several languages available is akin to having a variety of tools of any kind — it may help you do a particular job in a better, more efficient, or more illuminating manner.

The Assemblers

So much for the sermon. I'll begin this review of alternative languages with a tabulation of tools for a language which isn't really an "alternative" at all, but which is instead closely related to the intrinsic structure of the 6809: assembly language.

Purists claim that only those who write in assembly are entitled to call themselves programmers; everyone else is just a coder, setting up data for a real program (i.e. an interpreter or compiler) to manipulate.

Be that as it may, assembly language does allow one to gain really intimate control over a computer. The drawback is that it requires a corresponding depth of knowledge about the structure and operation of the machine.

Let's get the nomenclature straight. Microprocessors execute only binary machine language instructions, but like all computers of interest, the Color Computer incorporates a loader routine which accepts hexadecimal input. Thus it is common to speak of the hex representation as

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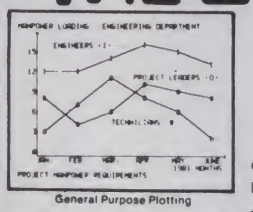

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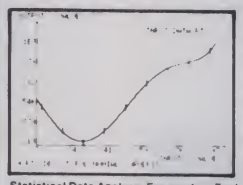

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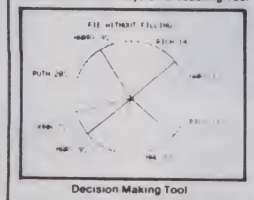

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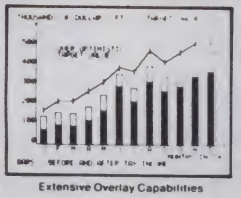

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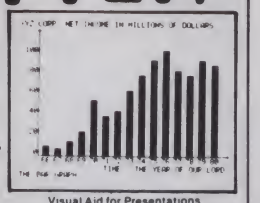

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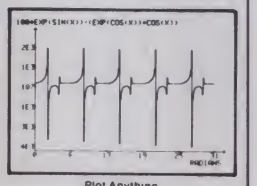

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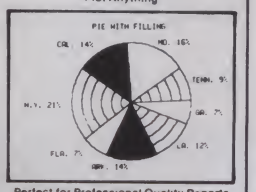

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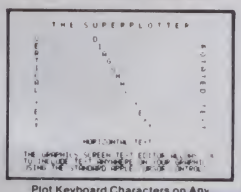

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Alternatives, continued...

machine language. The hex version of a routine can be loaded directly into any specified portion of memory with a monitor program. Alternatively, the hex characters can be converted to decimal in the fashion appropriate to the Color Computer and read from DATA statements.

Few people would care to do this for routines of any length, though, and fewer still would care to write programs from scratch in machine language. The code simply isn't meaningful to read, and it becomes very difficult to keep track of such things as the assignment of memory locations.

Assembly language comes to the rescue. It allows the programmer to use mnemonics to represent instructions, memory locations, registers, and subroutines, while retaining detailed control over machine operation. It is far easier, for example, to use the mnemonic ADDA to add the contents of a specified memory location to Accumulator A than it is to remember that BB is the machine language instruction which does this.

The usual procedure is to use a text editor to prepare the assembly language "source program" in the familiar columnar format. The source code is usually saved on tape or disk and subsequently read by the assembler program and translated into machine language. The output of the assembler, the "object program," is in turn loaded and run to execute the program.

Assemblers frequently require multiple passes (readings of the source code) to accomplish the translation. For example, the first pass might be used to construct a symbol table, a listing in RAM of user-defined names for special memory locations or parameters. The second pass would then perform the actual source code translation. Some assemblers permit "assembly direct to memory," which means that the object code could be executed at this stage. In other cases, the object code must be stored and subsequently loaded into RAM to be executed.

Table 1 is a listing of assemblers for the Color Computer; the vendor codes are explained in Table 4. There are several interesting things about this tabulation. For one, there is considerable diversity in price and in the minimum system required to support the various packages. There is also a great diversity in the features offered, which I will discuss in a moment. Another point: all of these programs except EDTASM+, which was released too late to be included in this review, are the products of independent vendors.

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Let's take a closer look at the table. I have tried to indicate which assemblers need an additional editor for source code preparation, to give you a feeling for total system cost. If you plan to do a great deal of assembly language programming, you may well want to investigate those packages which include co-resident editors. They can save a great deal of tape or disk swapping during the early stages of program development, when you will probably be correcting syntax and logic errors. (Or are you in the habit of writing perfect code from the beginning?)

As you can see, assemblers come in all three program configurations supported by the Color Computer — cassette, disk, and ROM pack. To my knowledge, all of them support the standard Motorola mnemonic set for the 6809. Some offer greater flexibility and additional features, however.

Frequently mentioned in this regard are the ability to handle local labels and conditional assembly. The former refers to labels for variables, etc., which are defined only within a particular section of a program and which can be re-used elsewhere. Conditional assembly allows different versions of a program to be assembled starting from the same source code, the modifications being dependent on parameters defined at assembly time. This clearly encourages programmers to develop their own libraries of frequently-used subroutines which can be patched together to build complex programs.

What about those entries for 64K systems? Conventional wisdom has it that Color Computers are limited to 32K of RAM, but it is well known that the Radio Shack 32K modification is accomplished with 64K memories, jumpers selecting one bank of 32K from each chip. Provided that both banks are good, a simple wiring change allows a re-mapping of the memory address space. The Basic ROMs are switched out of the circuit, and the entire 64K of RAM is made available to the user (except for a few hundred bytes required for a loader program). At this point, other disk operating systems can be used, making a great deal of software available to Color Computer owners. Flex, from Technical Systems Consultants, is available now, with Microware Systems' OS-9 promised for later in the year.

Both assemblers and high level languages are available to run under these DOSes, which shouldn't hurt the popularity of the Color Computer one bit. These things don't come for free, though, so there should still be a market for other language packages running under Radio Shack's DOS.

When should one use assembly language? It is frequently claimed that assembly programs are blindingly fast, perhaps 100 times or so faster than Basic. That is not strictly correct. It is the machine language output that is fast. The object code produced by, say, a Fortran compiler, can really zip along too. Still, this points us in the right direction.

Where speed is important, such as in real-time handling of I/O or graphics, assembly language has a lot going for it. It helps if you can write fairly small routines, too. Very long programs can be difficult to debug. Assembly language generally results in "tight" object code, so it can be very useful when memory is at a premium. It is also easiest to use in situations where number-crunching — at least of the floating-point variety — can be kept to a minimum.

Now it is time to look at alternative high level languages. It also seems worthwhile to split up the tabulation: Table 2 for products which run on unmodified Color Computers, Table 3

Table 1. Color Computer Assemblers.

Name (and Vendor Code)	Minimum System	Form	Price	Remarks
Programmers Tool Kit (CW)	16K	ROM + Tape	$179.95	Includes monitor, editor, assembler, diagnostics, and RAM.
Color assembler (CW)	32K	Tape	29.95	
Color editor (CW)	32K	Tape	29.95	
Disk Macro Assembler (CW)	32K	Disk	49.95	Requires editor
CO-RES9 (CC)	16K	Tape	39.95	Co-resident editor and assembler
CCASM9 (CC)	4K	Disk	34.95	Requires vendor's CCMD+9 disk operating system ($159.95), and editor.
CCEAD (ES)	16K	Tape	6.95	Editor, assembler, debugger (written in Basic).
Flex Editor and Assembler (HL)	64K	Disk	150.00	Flex operating system plus the editor and assembler.
Assembler (HL)	64K	Disk	50.00	Require Flex.
Editor (HL)	64K	Disk	50.00	
OS-9 Interactive Assembler (HL)	64K	Disk	125.00	Require OS-9 operating system
OS-9 Text Editor (HL)	64K	Disk	125.00	
SPS80C (MW)	16K	ROM	89.95	Editor, assembler, monitor
Macro-80C (MW)	16K	Disk	99.95	Three utilities, as above.
EDTASM (SA)	16K	Tape	34.95	Editor and assembler.
EDTASM+ (RS)	16K	ROM	44.95	Editor, assembler and monitor

Table 2. High Level Languages for Unmodified Color Computers.

Name (and Vendor Code)	Minimum System	Form	Price	Remarks
Tiny Compiler Basic (AA)	16K	Disk or Tape	$ 24.95	
Color Pascal (CW)	32K	Tape	49.95	Includes supervisor, editor
(actually Dynasoft v1.2)	32K	Disk	59.95	Requires ASCII text editor
Small C Compiler (DG)	16K	Disk	59.95	Requires assembler package
Colorforth (AR)	16K	Tape	49.95	Cassette also contains program for use with disk systems
CCForth (HL)	—	Disk	99.95	
Colorforth (TM)	4K	ROM	110.00	Disk versions available

for those requiring one of the alternative DOSes.

Other Basics

Why would anyone want to invest in another Basic when such a good one comes with the Color Computer? Well, remember my recitation of the acknowledged sins of Basic: slow speed and incompatibility with the precepts of structured programming? Products which attack both are now available.

Basic09 seems rich enough to keep anyone busy for quite a while.

Conventional Basic is slow because it is an interpreted language; every instruction must be decoded anew each time it is encountered, even if this means decoding the same thing hundreds of times within a loop. Compiled languages with machine language object code are much faster, and so it would seem worthwhile to produce a compiler which accepts Basic syntax for the source code.

What you give up is, of course, the immediacy of the programmer-computer interaction which makes Basic programs fairly easy to debug and modify. There is always the intermediate step of source code compilation to contend with.

As you might guess from the price differentials, the three alternative Basics listed in Tables 2 and 3 differ considerably in capability. In addition, none preserves the advanced graphics features of Extended Color Basic.

Aardvark's Tiny Compiler for the Radio Shack DOS handles only a small subset of Basic commands, and restricts the labels which you can assign to variables. It produces relocatable object code; thus you can use it to compile several subroutines which can later be called from Extended Color Basic by the USRn command. The compiler itself is written in Extended Color Basic, and occupies about 7.2K of RAM. The documentation is very complete, comprising a complete listing and several pages of descriptive comments.

As far as the restrictions are concerned, I must admit that the Tiny Compiler took me back to my first encounter with Basic, nearly 15 years ago. The IBM version of those days (run from a Teletype machine) restricted one to a single arithmetic command per statement, as does the Tiny Compiler. Thus A=B+C+D becomes

```
10 A=B+C
20 A=A+D
```

This is clearly not the vehicle for extensive computation. What might it be good for, then? My applications have stressed fast sorting routines. Even for nested FOR...NEXT loops (up to nine levels of nesting are allowed) the object code of Tiny Compiler is 15-20 times faster than Basic; for a single loop, the speed advantage is close to 30 times.

There are numerous syntax restrictions, violations of which are claimed to account for most of the errors encountered upon compilation. For example, variable names are limited to a single letter; dimensioned variables A(n)...Z(n) may have subscripts ranging from 0 to 128, although if you use only one dimensioned variable in a routine its subscript may range up to 999.

Programs destined for compilation can first be run with the Basic inter-

Table 3. High Level Languages for Alternative Operating Systems.

Name and Vendor Code	Price	Remarks
A/Basic (HL)	$150.00	Flex, OS-9 Versions Available
Basic09 (HL)	200.00	OS-9; from Microware
Dynasoft Pascal v1.3 (HL)	59.95	Flex; $89.95 with source code
Dynasoft Pascal v1.4 (HL)	69.95	OS-9; $99.95 with source code
OS-9 Pascal Compiler (HL)	400.00	From Microware; produces assembly language source code plus p-code
TSC Pascal (HL)	200.00	Flex; from Technical Systems Consultants
Omegasoft Pascal (OM)	425.00	Flex, OS-9 versions; assembly language output
C Compiler (MR)	400.00	OS-9; Unix version 7 language
C Compiler (WW)	52.50	Flex; upgrade program announced
DGS Flex C V2.0 (DG)	120.00	Flex; floating point math, etc.
DGS OS9 C V1.0 (DG)	95.00	OS-9
X-Forth (HL)	149.95	Flex
T-Forth (TM)	100.00	Flex, Extended Fig-Forth
T-Forth+ (TM)	250.00	as above, but enhanced
CIS Cobol Compiler (HL)	895.00	OS-9; ANSI 1974 Level 1 Standard

Table 4. Vendors of Alternative Languages.

AA	Aardvark-80 2352 S. Commerce Walled Lake, MI 48088
AR	Armadillo International Software P.O. Box 7661 Austin, TX 78712
CC	Cer-Comp 5566 Ricochet Ave. Las Vegas, NV 89110
CW	Computerware P.O. Box 668 Encinitas, CA 92024
DG	Dugger's Growing Systems P.O. Box 305 Solana Beach, CA 92075
ES	Eigen Systems P.O. Box 10234 Austin, TX 78766
HL	Frank Hogg Laboratory 130 Midtown Plaza Syracuse, NY 13210
MR	Microware Systems Corp. 5835 Grand Ave. Des Moines, IA 50312
MW	Micro Works P.O. Box 1110 Del Mar, CA 92014
OM	Omegasoft Industrial Products Group P.O. Box 70265 Sunnyvale, CA 94086
RS	Radio Shack Tandy Center Ft. Worth, TX
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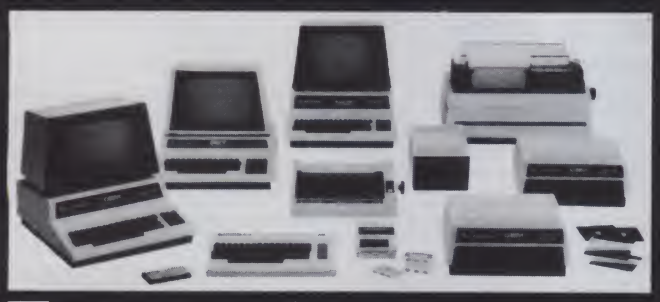

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preter and debugged in the usual way. When the source code is "clean," the Tiny Compiler can be invoked to generate object code. At this point the user may specify a choice of loading address, or use the compiler default. When compilation is complete the new code can be saved or run immediately.

The Tiny Compiler provides an interesting, if specialized, tool for owners of stock Color Computers. Upgrading to Flex or OS-9 makes more versatile languages available. For example, A/Basic features comprehensive string-handling functions and is claimed to compile to very efficient machine code, while retaining familiar Basic source code syntax. It benefits from several years' worth of experience with a similar language which runs on 6800 systems.

Microware's Basic09 is a different sort of beast. It incorporates many structured programming concepts, and bears more than a superficial resemblance to Pascal. Like most versions of Pascal, Basic09 compiles not to machine language, but to a standardized intermediate language which is later run under its own interpreter. The general idea is that the interpreter for the intermediate version (called I-code for Basic09, P-code for Pascal) can be a relatively simple affair. The compiler which generates the intermediate code is fairly complex, but can be made to run on a variety of machines — i.e. it, and the source code, can be portable.

In practice, portability is often compromised to capitalize on particular features of a given computer.

In any case, we are concerned with one language for one machine, and Basic09 seems rich enough to keep anyone busy for quite a while. While much of its syntax resembles that of other Basics, it features a wealth of modular programming features.

For example, program modules called procedures replace subroutines. Procedures can call one another, by name, from libraries built by the individual user. The concept of data typing is emphasized; Besides integers and real (floating point) numbers and strings, Basic09 permits the programmer to define Boolean and byte variables, as well as arbitrary combinations of elementary types.

With Pascal, as with the alternative Basic dialects, the color computer owner has options.

Basic09 supports new looping structures (WHILE—DO, REPEAT—UNTIL, and LOOP—ENDLOOP) in addition to FOR...NEXT. Coupled with the lack of line numbers and indented line format, these lend a definite Pascal-like look to Basic09 source code.

In addition to the I-code compiler and the run-time interpreter, the Basic09 package includes several features which speed the programming process. The source code editor is part of the compiler, for example, and the syntax of each source line is checked as it is entered. This means that "mechanical" errors can be found and corrected before time is wasted in attempting to compile an entire program. There is also a run-time debugger which helps in getting programs with more subtle logical flaws up and running properly.

Pascal

Basic09 may resemble Pascal, but don't think that is as close as the Color Computer can get. Several packages for the real thing are available for all Color Computer configurations.

Pascal is, of course, the very successful block-structured language developed in the late sixties by Professor Niklaus Wirth at the Swiss Federal Technical Institute. His stated purpose was to create a language suitable for teaching his concepts of disciplined, structured programming. He clearly succeeded.

Pascal has been widely implemented, and has influenced much subsequent work in the study of programming languages. It is not hard to learn, but don't be misled; to make the most effective use of Pascal, the average Basic programmer must change the way he approaches, and even thinks about, a programming task. This is well recognized, and several books specifically aimed at converting Basic programmers to Pascal have recently been published. Let me assume that you are sufficiently curious and motivated, then, and go on to discuss some of the software.

I was introduced to Pascal by Computerware's old, 16K-Plus-Power Pack version of Color Pascal, which has now been replaced by a pair of packages for 32K machines. I understand that the new cassette version resembles the one from which I learned. It includes a general control program called the Supervisor, together with an Editor and some monitor routines.

The Supervisor is used to control compilation and the loading and saving of both source and P-code programs. The disk system requires an external editor, capable of producing ASCII files, for source code preparation. It comprises a compiler and a run-time package which must be loaded separately at the appropriate times.

A copy of the source program should be made before attempting compilation, since this destroys the source — the only thing that can be edited if errors are found. It is also worthwhile to generate a printer listing of the compilation to keep track of errors, since there is no way to scroll back through a long screen listing. Error messages are generated as compilation proceeds. It is characteristic of Pascal that a syntax error early in a program may generate a large number of apparent errors later on, which magically disappear when the original offender is repaired.

I have gone on at some length about this to give you a feeling for the way you must be prepared to shuttle back and forth between programming tools (Editor, Supervisor, etc.) in a small system.

Of course, memory size imposes other restrictions. In the old version, at least, Color Pascal was a fairly limited subset of the language. It incorporated most of the standard control and decision structures (BEGIN—UNTIL, IF—THEN—ELSE, CASE, REPEAT—WHILE—UNTIL), but omitted some advanced data structures and floating-point arithmetic.

The 32K versions are somewhat more sophisticated in their handling of I/O, and the added memory lets the

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user be more relaxed about having to write and store floating-point math packages and personalized library procedures.

Dynasoft, the Nova Scotia firm which produced the original Color Pascal, has also created much more potent versions which run under Flex and OS-9. These feature advanced file-handling capabilities, floating-point math, and so on. Microware's OS-9 Pascal Compiler can produce two forms of output: P-code, for execution in an interpretive mode, and 6809 assembly language. The latter can then be compiled and run in the usual way, for maximum speed.

This brings up a good point: Pascal itself is not exceptionally fast. Since most P-code is run as an interpreted language, it is not uncommon to see only modest speed improvements (three to five times) over Basic. Of course, the straightforward structure imposed by Pascal may result in additional improvements because of the elimination of convoluted program branches.

The Microware compiler also features a form of virtual memory management, permitting the user to run larger programs that might seem feasible for a 48K machine (remember, 48K is what is left when OS-9 or Flex is used with a 64K machine).

Omegasoft's single-pass compiler also features assembly language output. It is part of a rather complete system of programming tools, including a symbolic debugger, run-time library, and file-handling utilities.

With Pascal, as with the alternative Basic dialects, the Color Computer owner has options. You can get a fairly inexpensive package that allows you to try out another language on a stock computer, or you can take the plunge and modify your machine for one of the advanced operating systems.

The C Language

C is a structured high level language, developed at Bell Laboratories in the early seventies, which has received a great deal of attention as the Primary language of Bell's Unix operating system. Unix is probably most commonly used for text manipulation, but C should be thought of as a fairly compact, general purpose language. In its full implementations, it supports most of the data structures, control capabilities, and data typing which characterize modern thinking of language design. Once again, Color Computer people can choose among C packages of various prices and capabilities.

Although there is a certain family resemblance between the source code

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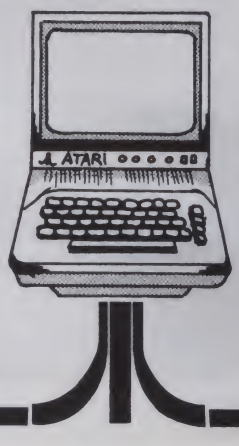

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listings of programs written in Pascal and those written in C, head-to-head comparisons between the two languages are not easy to make. For example, the two differ as to which features are included in the languages themselves and which must be provided by the programming environment.

The best-known example is input/output. The original specification of Pascal includes I/O considerations, but; in C, I/O chores are handled by standard library routines. (Even the least expensive C package for the Color Computer includes some really useful routines, however, capable of handling either single characters or fully formatted strings.)

In general, it is probably correct to say that Pascal is a relatively tightly-structured language designed to improve program reliability, while C has been made more "forgiving" to encourage a wider variety of applications. A recent review paper in the professional literature concluded that C is the better of the two languages for writing operating systems and system utilities, while Pascal is somewhat better suited for business programming.

Now let's look at what is available for the Color Computer. Small C Compiler, from Dugger's Growing Systems, for stock machines (16K or larger) requires an ASCII editor to create source code and an assembler to handle its own output. Assembled C programs can be called from Basic. The package lacks floating point math and some of the advanced data typing features of full-fledged C, but then it is still evolving — Dugger's promises future program enhancements, with maintenance by newsletter as warranted.

The manual is quite good, giving numerous illustrations of correct C syntax and pointing out the few substitutions necessary to handle the language with the limited character set of the Color Computer.

Dugger's Flex system, on the other hand, does include floating point and long (24-bit) numbers, as well as additional control features. The OS-9 version seems to be similar to the Small C Compiler, but adapted to the creation of program modules which can be linked, loaded, and run in the multi-tasking environment for which the operating system was created.

Microware's OS-9 version of C will be much more elaborate: a full implementation of the Unix Version 7 standard. It is not available as of this writing, but release is promised for the near future. The final entry, Flex9 from Word's Worth, is modestly priced and seems to offer a subset of the language. A specific program of upgrades through Versions 2.0 and 3.0 has been announced, although prices have not been set.

You can see, then, that the C situation is fairly fluid. Operators of each of the three Color Computer DOSes can obtain a limited-capability C, and Flex and OS-9 users, at least, can look forward to a much more capable system in the near future. That is probably not too bad a situation for this relatively new kid on the block.

Forth requires a fair degree of attention to detail on the part of the programmer.

Forth

Forth is very different in appearance and intent from Basic, Pascal, and C. It is a relatively small language of surprising power and great flexibility. Although most versions start with a well standardized set of dictionary entries (analogous to commands), the programmer is encouraged to expand the language to fit his needs.

Forth requires a fair degree of attention to detail on the part of the programmer — less than assembly language, but certainly more than the other high level languages I have been discussing. Its syntax can be rather involved, even comical.

My favorite example of a perfectly legitimate Forth statement (definition, actually) is

```
: ? @ . ;
```

Get the idea? Forth also has some of the most knowledgeable, enthusiastic, and opinionated adherents I have ever met — a characteristic it shares with APL, another language of considerable power and non-obvious syntax. A final characteristic of Forth is that its literature is full of awful titles: one Sets Forth, Goes Forth, Starts Forth, Ventures Forth, and so on.

What is the language all about? A few facts are easy to set down: Forth was invented by Charles Moore (who still heads a firm called Forth, Inc.), it has attracted quite a following among designers of computer-controlled instrumentation and machinery, and it can be used to support most computer applications. Forth experts will tell you that it isn't just a language, but a complete environment — an integrated set of programming tools.

Programming in Forth has its own flavor. You begin with a relatively standardized dictionary of approximately 150 high-level words. These are actually calls to lower-level subroutines, which may themselves contain additional calls.

Eventually the chain terminates with machine language code. However, the programmer is usually concerned with building up, away from the primitive definitions. The process is one of using the dictionary to define additional words which perform part of the task at hand. The last word defined is usually of such scope that when called, it executes the entire program. Some or all of the words defined in the programming process may be added to the dictionary for future use. I will later give some examples of interest to Color Computer users.

Forth is called a "threaded interpretive language," because of the "thread" of subroutine addresses leading from final definition down to machine code. To confuse matters a bit, though, there are both interpreter and compiler aspects to the language.

It relies heavily on manipulation of the parameter stack (a portion of RAM in which data are stored in last-in, first-out fashion) to pass operands and data from one word to another. Variables and constants can also be named, however, just as in other high level languages.

The user is responsible for keeping careful track of where items are on the stack. The explicit use of the stack also makes it reasonable for Forth to employ Reverse Polish Notation, in which mathematical or logical operations follow the operands to which they apply. The whole scheme is one which will be familiar to users of Hewlett-Packard Pocket calculators.

For an elementary example, here is how one might define a new word, CLEAR, to clear the CRT screen to a blank green field — just like the CLS command in the Color Basics. The definition will employ FILL, a word in the stock dictionary.

In accordance with Forth rules, the definition is begun with a colon and ends with a semicolon.

```
: CLEAR 1024 512 143 FILL ;
```

According to the syntax established for FILL, this instructs the computer to begin at address 1024 and load the next 512 locations with what Color Basic would call CHR$(13), a solid green block. Color Computer owners will, I hope, recognize 1024 as the address of the upper left corner of the low-resolution screen. Once CLEAR has been entered, it may be called by

name from any Forth program.

Forth makes it easy to gain control over such things as I/O, for which the Color Computer requires the setting of specific bits in the data at particular locations. This is the technique used to control the A/D converter and the sound generator, for instance.

At the same time, the language possesses a fair complement of control and decision structures, such as DO loops and IF — THEN and BEGIN — UNTIL constructs. Some versions have fairly extensive facilities for handling strings, as well. In other cases these must be defined by the user and added to a customized dictionary.

The nature of Forth is such that a 16K or 32K computer can support a fairly powerful version — its extensible nature helps a great deal, of course. Even the inexpensive Colorforth package from Armadillo Software gives you a generous slice to work with. Its main deficiencies seem to lie in the manipulation of double-length (32-bit) integers, a fairly standard feature of other Forths, and strings.

What one gains with the more elaborate packages seems to be enhanced text-handling capability and a more elaborate set of editing and compilation tools, plus of course the ability to write larger programs.

Cobol

I came to computing by the scientific computation route (Fortran and all that), and was taught that Cobol was a big, wordy, clumsy language. The fact that it has been for many years the most widely-known of all high level languages wasn't supposed to count, I guess. Anyway, it, too, is available.

I want people to take the machine seriously.

CIS Cobol Compiler from Microware is a 6809 version said to be compatible with CP/M applications software and the ANSI 1974 Level One Standard. It carries a pretty stiff price, but may just make it possible to put together a Color Computer based system capable of handling the computing chores for a small business in a professional fashion. For applications like this, the total system price should be fairly attractive.

Final Thoughts

In this review, I have tried to present as complete a picture as possible of the alternatives to Color Basic. I hope that you don't conclude from this that I am anti-Radio Shack or anti-Microsoft. On the contrary, I think that the Color Computer represents a remarkable value, and I enjoy using Extended Color Basic for much of my own work.

I want people to take the machine seriously, however, and I think it is worthwhile to spread the word about products and tools which enhance its capabilities. Many of the language packages discussed here fall into this category.

To be sure, some of the material for the stock machine cannot do much more than whet the appetite for a more elaborate version of a given language. That tends to be the result of limited memory size, although some of these products may also have suffered from an author's haste to get to the marketplace.

In any event, the availability of the Flex and OS-9 operating systems, with the concomitant expansion of user RAM to 48K, certainly opens the way for even more powerful and flexible software for the Color Computer. □

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Shugart SA801R *single-sided double-density*
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Shugart SA851R *double-sided double-density*
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MSF-558481 ..... $424.95 ea 2 for **$394.95 ea**

Tandon TM848-2 *double-sided double-den thin-line*
MSF-558482 ..... $574.95 ea 2 for **$549.95 ea**

Qume DT-8 *double-sided double-density*
MSF-750080 ..... $524.95 ea 2 for **$498.95 ea**

Mitsubishi M2894-63 *double-sided double-density*
MSF-289463 ..... $549.95 ea 2 for **$524.95 ea**

Siemens FDD 100-8 *single-sided double-density*
MSF-201120 ..... $334.95 ea 2 for **$349.95 ea**

Prices may be slightly higher at our retail locations. Please contact the store in your area for exact pricing.

Hard Disk Drives

12 MEGABYTE SUB-SYSTEM - DayStar

12 Megabyte Winchester sub-system for most CP/M based microcomputers including Apple II, S-100, IBM PC, NEC, Xerox, TRS-80 II, Heath H-89, and others. Sub-system includes interface, controller, cabinet, power supply, CP/M software patch, & cables - ready to just plug in and run. A 1 Megabyte back-up drive is also available.
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MSH-531020 *Apple II sub-system* **$2095.00**
MSH-531030 *NEC sub-system* **$2095.00**
MSH-531040 *Xerox sub-system* **$2095.00**
MSH-531050 *TRS-80 II sub-system* **$2095.00**
MSH-531060 *IBM PC sub-system* **$2095.00**
MSH-531099 *1 Megabyte back-up* **$699.95**

12 MEGABYTE WINCHESTER - Tandon

5¼" hard disk drive for hi-speed mass storage.
MSH-550603 *Bare 5¼" drive* **$1094.95**

Letter Quality Printers

TP-1 LETTER QUALITY - SCM

10 CPS daisy wheel printer from Smith Corona.
PRD-45101 *Centronics parallel* **$699.95**
PRD-45102 *Rs-232C serial* **$749.95**

LETTER QUALITY PRINTER - Jade

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PRD-11002 *RS-232C serial model* **$999.95**

STARWRITER F-10 - C. Itoh

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PRD-22010 *Starwriter F-10* **$1495.95**

80 CPS LETTER QUALITY - Fujitsu

High speed daisy wheel printer with both RS-232C serial & Centronics parallel interfaces, emulates NEC 5510, Diablo 630, Qume, and will interface to the IBM Personal Computer, features include Z-80 CPU, 16K buffer (48K optional), bi-directional printing, & baud rates up to 19.2K
PRD-86100 *Fujitsu with 16K* **$2895.00**
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MMD-5111603	*SS, SD, 16S*	**$29.00**
MMD-5120103	*SS, DD, 01S*	**$31.00**
MMD-5121003	*SS, DD, 010*	**$31.00**
MMD-5121603	*SS, DD, 16S*	**$31.00**

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MMD-8110103	*SS, SD, 01S*	**$31.00**
MMD-8120103	*SS, DD, 01S*	**$39.00**
MMD-8220103	*DS, DD, 01S*	**$48.00**

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MMD-5110105	*5¼" SS, DD, 01S*	**$19.95**
MMD-5220105	*5¼" DS, DD, 01S*	**$32.95**
MMD-8110105	*8" SS, SD, 01S*	**$24.95**
MMD-8120105	*8" SS, DD, 01S*	**$32.95**
MMD-8220105	*8" SS, DD, 01S*	**$35.95**

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HI-RES 12" GREEN - Zenith

15 MHz bandwith 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201 *List price $189.95* **$129.95**

12" GREEN SCREEN - NEC

20 MHz bandwidth, P31 phosphor ultra-high resolution video monitor with audio.

VDM-561200 *List price $289.95* **$199.95**

12" COLOR MONITOR - NEC

High resolution color monitor with audio.

VDC-651212 *Color monitor* **$389.95**
NEC-1202D *RGB color monitor* **$999.95**

13" COLOR MONITORS - BMC

18 MHz RGB & composite video color monitors.

VDC-421320 *13" RGB Color* **$329.95**
VDC-421310 *13" Composite video* **$299.95**
VDX-420090 *RGB card for Apple* **$149.95**

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VDC-801320 *13" Color II* **$894.95**
IOV-2300A *DVM board for Apple* **$199.95**

AMBER or GREEN MONITORS - Jade

High resolution 18 MHz compact video monitors.

VDM-751210 *12" Amber phosphor* **$149.95**
VDM-751220 *12" Green phosphor* **$139.95**
VDM-750910 *9" Amber phosphor* **$149.95**
VDM-750920 *9" Green phosphor* **$139.95**

Modems

SIGNALMAN - Anchor

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IOM-5600A *Signalman* **$98.50**

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IOM-5400A *Smartmodem* **$248.95**
IOK-1500A *Hayes Chronograph* **$218.95**
IOM-2010A *Micromodem II* **$328.95**
IOM-1100A *Micromodem 100* **$368.95**

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ULTRA-VIOLET EPROM ERASERS

Inexpensive erasers for industry or home.

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Single User System

THREE BOARD SET - SD Systems

4 MHz Z-80A CPU, 64K RAM (optional 256K), serial I/O port, parallel I/O port, double density disk controller, CP/M 2.2 & manual set, system monitor, control & diagnostic software. Includes SBC-200, 64K ExpandoRAM II, Versafloppy II, & CP/M 2.2 - all boards are assembled & tested.

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Apple II Accessories

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16700A *Save $125.00 !!!* **$69.95**

ADD-ON DISK DRIVE - for Apple II

Inexpensive direct replacement for Apple Disk II, works with Apple II controller as first or second drive.

MSM-123200 *Add On Drive* **$319.95**
MSM-123100 *Controller* **$94.95**

Z-80 CPU CARD - for Apple II

Two computers in one, Z-80 & 6502, more than doubles the power and potential of your Apple, includes Z-80 CPU card CP/M and complete manual set.

CPX-62800A *A & T with software* **$249.95**

8" DISK CONTROLLER - Vista

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CP/M 2.2, Shugart & Qume compatible

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Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package *Kit* **$1495.00**
1 MegaByte Package *A & T* **$1695.00**
2 MegaByte Package *Kit* **$1795.00**
2 MegaByte Package *A & T* **$1995.95**

APPLE-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

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Single Board Computer

SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4 MHz Z-80A, single or double density disk controller for 5¼" or 8" drives, 64K RAM, extended addressing, up to 4K of EPROM, 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

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IOX-4232A *Serial I/O adapter* **$29.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook.

CPS-30100K *Kit with workbook* **$299.95**
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AIM-65 - Rockwell International

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CPK-50165A *1K AIM-65* **$424.95**
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SFK-64600004E *4K assembler ROM* **$43.95**
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SFK-74600010E *Forth ROM* **$64.95**
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SPECIAL PACKAGE

4K AIM-65, 8K Basic, power supply, & enclosure

Special Package Price **$649.95**

S-100 EPROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software.

MEM-99520K *Kit with software* **$189.95**
MEM-99520A *A & T with software* **$249.95**

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K *Kit with manual* **$154.95**
MEM-99510A *A & T with manual* **$219.95**

EPROM BOARD - Jade

16K or 32K uses 2708 or 2716 EPROMs, 1K boundary.

MEM-16230K *Kit w/o EPROMs* **$79.95**
MEM-16230A *A & T w/o EPROMs* **$119.95**

S-100 Video Boards

SPECTRUM COLOR - CompuPro

Full-function color graphics board, up to 8 colors, 256 x 192 graphics, parallel I/O port, 8K RAM.

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MBS-121K *Kit* **$69.95**
MBS-121A *A & T* **$99.95**

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MBS-181K *Kit* **$99.95**
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CPU-70530A	with 8087 A & T	$1224.95
CPU-70530C	with 8087 CSC	$1455.95

8085/8086 - CompuPro
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CPU-20510A	6 MHz A & T	$398.95
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CPU-Z - CompuPro
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CPU-30500C	3 6 MHz CSC	$374.95

SBC-200 - SD Systems
4 MHz Z-80A CPU with serial & parallel I O, 1K RAM, 8K ROM space, monitor PROM included

CPC-30200A	A & T	$399.95

THE BIG Z - Jade
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CPU-30201B	Bare board w manual	$35.00
CPU-30201K	Kit with manual	$149.95
CPU-30210A	A & T with manual	$199.95

CB-2 - SSM Microcomputer
2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible

CPU-30300K	Kit with manual	$229.95
CPU-30300A	A & T with manual	$274.95

2810 Z-80 CPU - C.C.S.
2 or 4 MHZ Z-80 CPU with serial I O port & on-board monitor PROM, front panel compatible

CPU-30400A	A & T with PROM	$289.95

2820 Z-80 DMA CPU - C.C.S.
4 MHz Z-80 CPU board with 2 serial I O ports & Centronics parallel I O port, separate data & status ports, DMA daisy chain compatible

CPU-30420A	A & T with manual	$569.95

S-100 Disk Controllers

DISK 1 - CompuPro
8" or 5¼" DMA disk controller, single or double density, single or double sided, 10 MHz

IOD-1810A	A & T	$449.95
IOD-1810C	CSC	$554.95
SFC-52506580F	8" CP M 2 2 for Z-80	$174.95
SFC-52506586F	8" CP M 2 2 for 8086	$299.95
SFO-54158000F	Oasis single user	$499.95
SFO-54158002F	Oasis multi-user	$849.95

VERSAFLOPPY II - SD Systems
Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts, CP M 2.2 & Oasis compatible, control diagnostic software PROM included

IOD-1160A	A & T with PROM	$359.95
SFC-55009047F	CP M 2 2 with VF II	$99.95

2242 DISK CONTROLLER - C.C.S.
5¼" or 8" double density disk controller with on-board boot loader ROM, free CP M 2 2 & manual set

IOD-1300A	A & T with CP M 2 2	$399.95

DOUBLE D - Jade
High reliablity double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100, can function in multi-user interrupt driven bus

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IOD-1200K	Kit w hdwr & sftwr man	$299.95
IOD-1200A	A & T w hdwr & sftwr man	$359.95
SFC-59002001F	CP M 2 2 with Double D	$99.95

S-100 Memory Boards

256K RAMDISK - SD Systems
ExpandoRAM III expandable from 64K to 256K using 64K x 1 RAM chips, compatible with CP/M, MP/M, Oasis, Cromemco, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software

MEM-65064A	64K A & T	$474.95
MEM-65128A	128K A & T	$574.95
MEM-65192A	192K A & T	$674.95
MEM-65256A	256K A & T	$774.95
SFC-55009000F	RAMDISK sftwr CP M 2 2	$44.95
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128K RAM 21 - CompuPro
128K x 8 bit or 64K x 16 bit static RAM board, 12 MHz, 24 bit addressing

MEM-12810A	A & T	$1609.95
MEM-12810C	CSC	$1794.95

64K RAM 17 - CompuPro
64K CMOS static RAM board, 10 MHz, low power less than 4 watts, DMA compatible, 24 bit addressing

MEM-64180A	64K A & T	$549.95
MEM-64180C	64K CSC	$698.95

64K RAM 16 - CompuPro
32K x 16 bit or 64K x 8 bit low power static RAM board, 10 MHz, 24 bit addressing

MEM-32180A	RAM 16 A & T	$598.95
MEM-32180C	RAM 16 CSC	$698.95

64K STATIC RAM - SSM
IEEE 696 S-100 standard, up to 6MHz 8 Bit, 12MHz 16 Bit, 24 Bit extended addressing, disable-able in 2K increments

MEM-64300A	A & T	$499.95

64K STATIC RAM - Mem Merchant
64K static S-100 RAM card, 4 to 16K banks up to 8 MHz

MEM-64400A	64K A & T	$499.95

2065 64K RAM - C.C.S.
4 MHz bank port bank byte selectable, extended addressing, 16K bank selectable, front panel compatible

MEM-64565A	64K A & T	$349.95

2066 64K RAM - C.C.S.
64K RAM board with bank and block select switching functions for Cromemeco Cromix & Alpha Micro

MEM-64566A	64K A & T	$424.95

64K EXPANDORAM II - SD Systems
Expandable RAM board from 16K to 64K using 4116 RAM chips

MEM-16630A	16K A & T	$344.95
MEM-32631A	32K A & T	$364.95
MEM-48632A	48K A & T	$384.95
MEM-64633A	64K A & T	$399.95

MEMORY BANK - Jade
4 MHz S-100 bank selectable expandable to 64K

MEM-99730B	Bare board w manual	$49.95
MEM-99730K	Kit with no RAM	$179.95
MEM-32731K	32K kit	$199.95
MEM-64733K	64K kit	$249.95
Assembled & Tested		add $50.00

32K RAM 20 - CompuPro
32K static RAM, up to 10 MHz, disable-able in 4K banks, bank select or 24 bit addressing

MEM-16180A	16K A & T	$259.95
MEM-16180C	16K CSC	$324.95
MEM-24180A	24K A & T	$324.95
MEM-24180C	24K CSC	$384.95
MEM-32185A	32K A & T	$384.95
MEM-32185C	32K CSC	$449.95

16K STATIC RAM - Mem Merchant
4MHz lo-power static RAM board, IEEE S-100, bank selectable, addressable in 4K blocks, disable-able in 1K segments extended addressing

MEM-16171A	16K A & T	$149.95

S-100 I/O Boards

SYSTEM SUPPORT 1 - CompuPro
Real time clock, three 16 bit interval timers, dual interrupt controllers(15 levels), up to 4K EPROM RAM, RS-232C serial channel, provision for 9511A 9512 math chip

IOX-1850A	SS1 A & T	$359.95
IOX-1850C	SS1 CSC	$459.95
IOX-1855A	with 9511 A & T	$554.95
IOX-1855C	with 9511 CSC	$654.95
IOX-1860A	with 9512 A & T	$554.95
IOX-1860C	with 9512 CSC	$654.95

INTERFACER 1 - CompuPro
2 serial I O ports 50-19 2K baud

IOI-1810A	A & T	$218.95
IOI-1810C	CSC	$288.95

INTERFACER 2 - CompuPro
3 parallel, 1 serial, & interrupt timer

IOI-1820A	A & T	$218.95
IOI-1820C	CSC	$288.95

INTERFACER 3 - CompuPro
5 or 8 channel serial I O board for interrupt driven multi-user systems up to 250K baud

IOI-1835A	5 port A & T	$558.95
IOI-1835C	5 port CSC	$628.95
IOI-1838A	8 port A & T	$628.95
IOI-1838C	8 port CSC	$749.95

INTERFACER 4 - CompuPro
3 serial, 1 parallel, 1 Centronics parallel

IOI-1840A	A & T	$314.95
IOI-1840C	CSC	$414.95

MPX - CompuPro
Multi-user I O multiplexer & interrupt controller with on-board 8085A-2 CPU & 4K or 16K of RAM

IOI-1875A	4K MPX A & T	$444.95
IOI-1875C	4K MPX CSC	$534.95
IOI-1880A	16K MPX A & T	$584.95
IOI-1880C	16K MPX CSC	$674.95

I/O-8 - SSM Microcomputer
Eight software programmable serial I O ports, 110 -19 2K Baud, ideal for multi-user systems

IOI-1018A	A & T	$469.95

I/O-5 - SSM Microcomputer
Two serial & 3 parallel I O ports, 110-19 2K Baud

IOI-1015A	A & T	$289.95

MPC-4 - SD Systems
Intelligent 4-port serial I O card, on-board Z-80A, 2K RAM, 4K PROM area, on-board firmware, fully buffered, vectored interrupts, four CTC channels, add to SD Board set for powerful multi-user system

IOI-1504A	A & T w software	$495.00

I/O-4 - SSM Microcomputer
2 serial I O ports plus 2 parallel I O ports

IOI-1010B	Bare board w/manual	$35.00
IOI-1010K	Kit with manual	$179.95
IOI-1010A	A & T with manual	$249.95

2830 6 PORT SERIAL - C.C.S.
Six asynchronous RS-232C serial I/O ports with programmable baud rates

IOI-1040A	A & T with manual	$529.95

2710 4 PORT SERIAL - C.C.S.
Four RS-232C serial I/O ports with full handshaking

IOI-1060A	A & T with manual	$319.95

2719 2 SER & 2 PAR - C.C.S.
Two RS-232C serial I/O ports plus two 8 bit parallel I/O ports

IOI-1080A	A & T with manual	$349.95

Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

An Editor-Assembler For the Color Computer

Dennis Wilkins

Although the Color Computer belongs to my kids, I occasionally get a chance to play with it. Radio Shack has been quite open about describing the technical features of the Color Computer, and the 6809 processor is a very capable CPU. But without a good monitor and editor-assembler it can't be fully utilized. EDTASM+ from Radio Shack is the editor-assembler we have been waiting for.

I bought EDTASM+ when the kids weren't looking and managed to get it home without their realizing that Dad had bought a non-game program cartridge for their machine. That night, after the little critters were tucked away, I plugged in the new pack and powered up. The TV flickered to life, and the familiar green screen printed out EDTASM+ 1.0, COPYRIGHT 1981 BY MICROSOFT. Boot time for the 8K program is about one second. Loading such a large program from cassette would take nearly a minute.

What is EDTASM+

EDTASM+ is an editor, an assembler, and a monitor (named ZBUG) for the TRS-80 Color Computer. It comes in a ROM cartridge, and is designed to be used with a tape based 16K or 32K unit. It does not require the Extended Color Basic. And it does not use up precious RAM (well, only about 500 bytes for program overhead). Presumably a disk-based editor will be available from Radio Shack some day (there are some being advertised from other firms already).

Dennis J. Wilkins, 4000 Capitol Drive, Fort Collins, CO 80526.

creative computing
SOFTWARE PROFILE

Name: EDTASM+
Type: Editor/assembler
System: TRS-80 Color Computer
Format: ROM cartridge
Language: Machine
Summary: Finally a ROM cartridge for Dad!
Price: $49.95
Manufacturer:
Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

So, what has Microsoft accomplished with this new package? Quite a lot. The ZBUG monitor is a fine utility itself. It allows you to view any memory location in several modes.

The byte mode displays the value of one memory location (one byte of memory) per line. Normally the bytes will be displayed in hexadecimal, but can also be set to decimal or octal representation. There is a word mode which displays two bytes of code per line.

The ASCII mode displays the character representation of any byte between 21 and 7F (hexadecimal), which makes it easy to decipher text buried in a program. Code outside of this range is displayed as a blank. I think it would have been better to revert to byte representation for non-ASCII code.

ZBUG also has a mnemonic mode which automatically disassembles one to five bytes of memory into one line of assembly language. A built-in disassembler — I certainly hadn't expected that from Radio Shack.

When viewing memory on screen, ZBUG allows you to advance to the next memory location or back up to the previous one using the down/up arrows, and to change the content of RAM in the byte, word, ASCII, or mnemonic modes (although in the mnemonic mode you must enter the OP codes, rather than assembly language).

ZBUG also allows you to display a range of memory locations — even a whole program — with one command, and send the listing to the video screen or to a printer. Thus, you can produce a disassembled listing of any portion of the Color Computer memory. Times have changed since the days Radio Shack wouldn't admit there was any software in a TRS-80.

ZBUG has some additional features which are most useful for debugging assembled programs. In addition to its byte, word, ASCII, and mnemonic modes, ZBUG has three sub-modes available: numeric mode, symbolic mode, and half-symbolic mode. When used with the mnemonic mode, the numeric mode will not show the labels used in your program, but will show the memory address indicated by any label. The symbolic mode shows the actual labels used in a program. Half-

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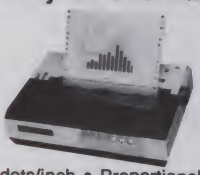

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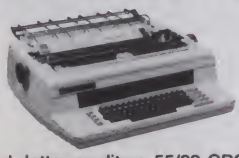

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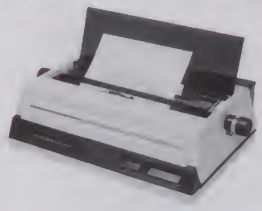

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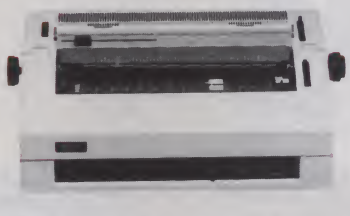

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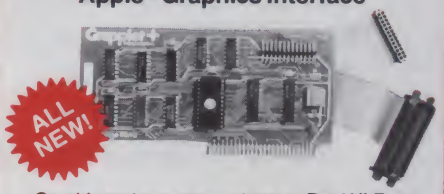

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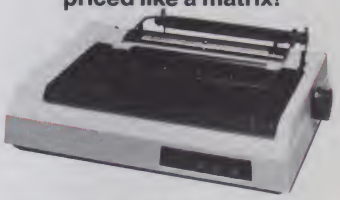

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symbolic mode shows all memory location identifiers in their symbolic form, but displays operands as addresses.

ZBUG even understands symbols used in commands when an assembled program is in memory. For example, if you labeled the beginning of a program residing at 3F00 hex START, you could command ZBUG to display the first byte of the program by typing START/, or by typing 3F00/. And you could run the program with the command G START, rather than specifying the start address.

There are other useful capabilities in ZBUG. Up to eight break points can be set to halt execution at specified points in a program run. The breakpoints can be individually reset, or all breakpoints cancelled, and the memory locations of all currently set breakpoints can be displayed. Programs can be single stepped, for ease of debugging, and all register values and flag conditions can be observed after any step or after a breakpoint halt.

"Actually, I'm not even sure if I want to know what 'Punk Fortran' is."

There is a transfer command in ZBUG to move code from one memory area to another. This command does not modify code to correct address references (as the Basic renumber does for GOTOs and GOSUBs), it simply copies the code from one location to another. ZBUG can save a specified block of memory to cassette, with loading and start addresses specified, and can read a tape into memory. This allows linking short routines into a longer program with the proper planning.

ZBUG also has a calculator mode which can perform arithmetic, relational, and logical operations using hexadecimal, decimal, or octal numbers; ASCII characters; and symbols for logical operations. Logical operators allowed are: equals, not equal, addition, subtraction, multiplication, division, modulus, positive, negative, logical shifts, complements, and logical AND, OR, and XOR.

In the calculator mode ZBUG allows you to mix modes. For example, you can compute the sum of A3FE hexadecimal plus 1354 decimal. Or you can command the monitor to display the memory location described by the sum of 3471 octal plus 1A34 hexadecimal. It is possible to control the number base of inputs and the number base of outputs separately, so that you can type commands in decimal, but have outputs displayed in hexadecimal. Note that since the calculator mode of ZBUG was intended as an aid during program writing, it will not display negative values and the maximum value it will display is FFFF hex (65535 decimal).

The Editor

The monitor is very useful, but what about the editor. The editor is quite similar to Radio Shack's editor-assembler for the TRS-80 Model 1, except that you must use 6809 mnemonics instead of Z80 mnemonics. The editor has the usual auto line numbering, insertion, replacement, and deletion of lines, a renumber command, an edit line command, save and load to cassette, screen print, and line printer commands. It also has a handy copy command to duplicate code, a move command to block move code, a find command to find occurrences of a specified string of characters, a ZBUG command to jump to ZBUG (without changing any of the text buffer), and a Basic command to jump to Basic (which destroys the text buffer). The ability to jump to ZBUG, make calculations or number/symbol conversions, and return to the editor with all text intact is very convenient.

The editor allows you to work in decimal or hexadecimal, but has a slight inconsistency with ZBUG: default is decimal in the editor and hexadecimal in ZBUG. ZBUG allows you to define the number base in which you wish to work, but the editor requires that you specify hex each time you mean hex. Otherwise it thinks you mean decimal.

One useful feature of EDTASM+ is its ability to edit Basic programs. It has some useful commands which are not in the edit system of Extended Basic, such as the Find and Copy commands, and the ability to scroll lines with the arrow keys. The manual states that Basic programs can be edited, but does not describe how.

Since EDTASM+ can be used with a non-Extended Color Basic machine, it is an inexpensive way to obtain some editing features.

The Basic program must be saved in the ASCII mode (CSAVE"PROGRAM",A) from Basic, then loaded into the text buffer of the editor from tape. It must be saved again from the editor, and then CLOADed when you have returned to Basic.

You cannot just call the editor from Basic to edit programs. For complex editing of long Basic programs it is worth the effort. For quick changes to short programs the normal Basic EDIT command is best.

Since EDTASM+ can be used with a non-Extended Color Basic machine it is an inexpensive way to obtain some editing features. Also, the editor allows you to append text from a tape file onto the end of the current text buffer in memory. This can be used in both Basic and assembly language programming to link short routines into one long program.

There's Even an Assembler

Yes, they even remembered the assembler. The assembler is activated from the editor by typing A filename. This command assembles the text in the editor and writes it to a cassette file named "filename." If you want to assemble the code and test it before saving it to cassette, there is an in-memory switch (IM) available.

Eight other switches for the

assembler control error display mode, listing mode (short listing, no symbol table in listing, list to printer, and no listing), compilation, and method of specifying start location of assembled code (absolute origin and manual origin).

A /NO command explained in the manual on page 13 is supposed to prevent object code from showing in the assembler listing. A /NO command explained on page 16 is supposed to prevent object code from being recorded to memory or to tape. My tests show that the function of /NO is as explained on page 16 (it can be used to test for compile errors without storing the object code).

EDTASM+ seems to work well, and has an excellent interface between the monitor and editor. It certainly provides more access to the TRS-80 Color Computer than has been available before.

The Manual

The EDTASM+ manual is, for the most part an example of clear writing style and completeness. There are, however, not many examples of how to write in assembly language. The manual states right at the beginning: "This manual demonstrates how to use the Editor-Assembler+. It will not teach you how to program in assembly language. Radio Shack has an excellent book devoted to the subject. It's Catalog Number is 62-2077. You can purchase it through any Radio Shack store."

This statement is correct, up to the last line. At the time of this writing book 62-2077 was not available. It should be available by the time this is published. There are several other books available which discuss programming of the 6809, but not at Radio Shack. The Radio Shack book could be very useful if it has been specifically written for the Color Computer hardware/firmware.

The manual does describe how to use the monitor, the editor, and the assembler, and includes a list of ROM routine entry points (as do the Basic and Extended Basic manuals). The shack seems to be getting downright helpful. The manual even has a section on running machine code routines produced by EDTASM+ from Basic programs, including parameter passing.

The manual devotes 26 pages to operating EDTASM+, has a 23 page-reference section on 6809 assembly language, and 11 pages of appendices (editor command set, assembler commands, ZBUG commands, error messages, memory map, and ROM routine descriptions). The appendices on commands also reference the page on which the command is discussed, although I found a few errors in that regard.

The only thing lacking in the manual is graphics. Several sections describe a video display without showing a graphic representation of it, although page 14 does show two examples of an assembly display listing. There are also a couple of editor commands which are not fully explained in the editor chapter (Find and Verify file), but are mentioned in the appendix. And I found a few types which were not difficult to decipher. On the whole, the manual is organized well and clearly written.

Was It Worth the Wait?

I must admit that I am impressed with this offering from Radio Shack. They are not just supporting the Color Computer with game packs these days. This offering allows the serious programmer to produce some compact programs with very high speed graphics, and allows the beginner and hobbyist to explore the inner workings of his Color Computer. EDTASM+ is $49.95 at your local Radio Shack store. □

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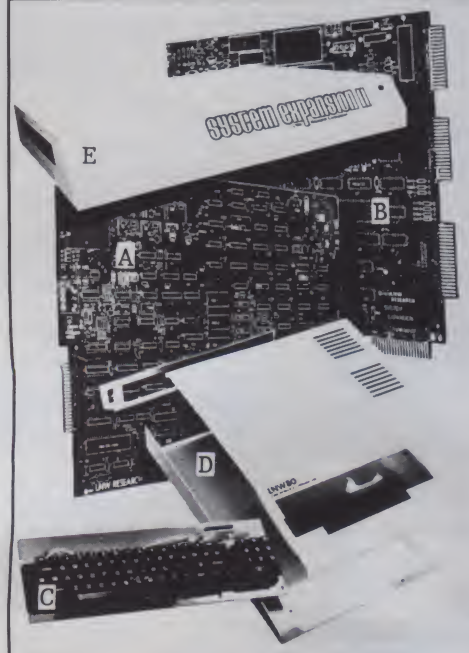

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An Alternative to Atari DOS

Sheldon Leemon

K-DOS from K-Byte is an alternative to the Atari Disk Operating System, DOS II. The file management system of *K-DOS* is compatible with Atari DOS, but offers a greater level of control over peripheral devices and memory. Although it offers many features which will be appreciated by every Atari user, *K-DOS* will be of most use to the serious programmer.

Since the benefits to be gained by using *K-DOS* are the result of certain trade-offs, the potential buyer should think hard about how much a more convenient disk operating system is really worth.

Chief among these trade-offs is the amount of memory that *K-DOS* leaves available to the user. *K-DOS* is memory resident, so most of its features are immediately accessible, but it also takes up a great deal of space. With a Basic cartridge inserted, the amount of free memory available in a 40K system is 25,228 bytes. This is almost 7K less than the 32,274 bytes available with Atari DOS, or the 31,758 bytes available with OS/A+.

Besides reducing the amount of memory available for programming, the large size of *K-DOS* puts the start of low memory above $3000. (An optional program included with the package lets you remove the plain English error messages, which saves enough bytes to bring the end of *K-DOS* just below $3000). Machine language programs which are assembled to run just above the end of Atari DOS, may conflict with *K-DOS*, and may not run under it.

If you have memory to spare, however, *K-DOS* offers many attractive features. It is, for example, a pleasure to use: all DOS functions are accessible from Basic, Pilot, the Assembler cartridge, or whatever program environment you happen to be in.

Sheldon Leemon, 14400 Elm, Oak Park, MI 48237.

If you have memory to spare, K-DOS offers many attractive features.

Since *K-DOS* is command driven, you need not call up a menu to execute a DOS function. You simply precede the command by a comma (or some other character which you can define as significant to DOS), and the DOS function is executed without changing program environments.

The syntax required for command lines is flexible, so commas can be replaced by spaces, lower case is acceptable, and the DOS environment automatically resets the inverse character shift. Device defaults are supplied whenever possible, and short abbreviations are allowed, so a minimum of keystrokes is required to perform any function. Error messages appear in plain English, rather than a frustrating number code.

Unlike OS/A+, which puts you back in the operating system every time you hit System Reset, *K-DOS* will only bypass Basic if you hit the Start key along with System Reset. And unlike Atari DOS, the device handler for the 850 interface unit boots automatically if it is turned on. There is no need for a separate AUTORUN.SYS file.

The reason that *K-DOS* can let you use DOS command lines from Basic is that it re-routes all input to the line editor (although it gives you a command, KILL, which will take its "hooks" out of the handler table if desired).

This greater level of control over the system is characteristic of *K-DOS*. For example, the 6502 BREAK instruction is vectored to get you back to DOS any time the instruction is encountered, rather than having the system hang up. You may get a little better idea of what this means if you slip in the Basic cartridge and type INPUT (RETURN).

With Atari DOS II, the system locks up, and the only way to recover is to turn the computer off and reboot. With *K-DOS*, a BRK message appears, and you enter DOS. You should even be able to recover from the dreaded "editing lock-up," which occurs when Basic moves a block of exactly 256 bytes (You must still know enough about how Basic works to reset the statement pointers, however, as that particular bug tampers with your program code before it crashes the system).

Another aspect of the system control offered by *K-DOS* is that it allows you to stop disk I/O just by hitting the BREAK

creative computing
SOFTWARE PROFILE

Name: K-Dos
Type: Operating system
System: Atari 400/800, 48K preferable
Format: Disk
Language: Machine
Summary: Versatile, but memory-hungry alternative to Atari DOS
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key, without destroying your data. It also tries very hard to read and write marginal sectors before bombing out, which is important, given the notorious speed fluctuation of older Atari disk drives.

K-DOS puts some nice touches on some of the original DOS functions. For example, INIT combines formatting and writing DOS files to the new disk in one operation, although these functions are still available separately. The duplicate disk function offers the option of a straight sector copy for boot-disks that do not have file information on them, and also allows the faster write without verify and continuous retrying of bad sectors.

There is a separate APPEND command, which allows you to enter data at the end of a file directly from the keyboard. The append function uses any space available in the last sector, rather than starting a new sector as Atari DOS does. The binary load command prints to the screen the location in memory into which the file is being loaded, if you so desire, which is much more convenient than reading the headers and calculating the addresses by yourself.

But *K-DOS* doesn't take up all that memory for the sake of a few slight modifications. It also contains a complete machine language monitor which allows you to examine memory in hexadecimal and ASCII formats, alter memory by typing in either hex or ASCII values, and examine and alter the contents of the registers. *K-DOS* gives you two ways to execute a machine language program. GO runs the program after closing all devices, and does not preserve the registers. PROCEED continues a program after a breakpoint has been reached, without changing the contents of the registers or the status of any device, making it a very handy debugging tool.

Similarly, the command XIT allows you to get back to a Basic program that calls DOS, and continues to run that program from the point at which DOS was called.

A null device handler has been added, so that you can test I/O operations quickly by directing them to N:. LOMEM lets you examine and alter the bottom of memory available to a cartridge. This allows you to reserve space for machine language programs, or just to reduce the amount of memory available to see if a Basic program will run on the minimum 16K system. UDC allows you to add your own user-defined commands to the system.

In addition, *K-DOS* offers many commands which allow you to access certain routines used internally by DOS, just by giving a one-word command. For example, COLD and WARM provide an easy way to coldstart or warmstart a cartridge. RESET reboots the 850 handler when you have expanded the drive buffers —or just forgotten to turn it on when you booted up.

TEXT corresponds to a GRAPHICS 0 call in Basic, and opens the screen device, which is handy for moving the display list when you want to load a program into high memory. CLOSE closes all files, turns off the sound, resets VBLANK vectors, and turns off Player-Missile graphics. ER followed by a number will print the English error message for that error number, which is very handy when you want to interpret I/O errors that are generated by Basic.

It is a convenient tool for the user who is serious about programming.

None of these functions is earth-shaking, and all can be accomplished in other ways with a little effort, but the author's attitude was that as long as the routines for doing them were already in DOS, it made sense to allow them to be accessed easily.

Unfortunately, the lack of depth in the documentation runs somewhat counter to this intention of allowing the programmer easy access. The glossy K-DOS Handbook is nicely bound, comes with a pocket summary card, is clearly written, gives examples of the proper syntax for each command, and covers most of the commands very well.

However, it treats some of the more esoteric commands in a cursory manner. Take, for example, the explanation of the UNLOAD command: "Tries to erase area where cartridge is; unloads any RAM based cartridge and resets LOMEM back to end of DOS." The beginner will no doubt read this sentence, re-read it once to verify that all of the words are in English, and then press on, no better or worse for the experience.

The experienced user, on the other hand, might gather from this explanation that it is possible to load a program into RAM, and fool the system into thinking that the program is cartridge-based, allowing an easy transition back and forth between that program environment and DOS. The inference would then be that the UNLOAD command erases this program, and lets the system know that no cartridge is present. But how do you set up this "RAM based cartridge" in the first place? No clue is given, leaving the experienced user perhaps more frustrated than the beginner.

Another example of a similar sort is the system equate files that are supposed to give the user access to system routines, such as the one to type text messages from a buffer. There are no detailed examples of how to use them, however, and the internal commenting is too scanty to allow most users to benefit from them. Features like these could be real selling points to the ambitious programmer if they were treated less superficially in the documentation.

My impression of *K-DOS* is that aside from these omissions in the documentation, it is a convenient tool for the user who is serious about programming.

As one who uses his computer mostly for programming, I have found *K-DOS* especially helpful in developing software that combines Basic with machine language subroutines. But I think that *K-DOS* will be of much less interest to the casual programmer who may have less than 40K of memory.

While such a user might appreciate some of the features, he would probably never take advantage of the machine language monitor, the null device, or many of the other goodies which make *K-DOS* so big—and so expensive. If you fall into that category, you might be better off spending the money on something that will let you gobble dots, eradicate insects, or save the universe. □

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CIRCLE 181 ON READER SERVICE CARD

Enhance your Apple II monitor with this versatile product.

MON+ by Microseeds

David H. Ahl

MON+ is an extension to the Apple II monitor, which enhances existing commands and adds some powerful new commands of its own.

Four years ago, when the Apple was introduced, the supplied monitor was more than adequate. It contains tools to display memory, disassemble code, add and subtract numbers, and read and write cassettes. Today, however, people are pushing the Apple farther perhaps than even the original designers envisioned. The disk drive has replaced the cassette recorder as the common I/O device. There are excellent assemblers and scores of hi-res games. However, these sophisticated applications must be done with, or perhaps despite, the existing monitor.

MON+ addresses many of the limitations of the existing Apple monitor with modified extensions of the existing commands as well as six new commands. All of these commands are shown in Table 1.

A particularly useful command for machine language programmers is the "single step and trace." For the most part, these commands are the same as the monitor's single step and trace commands, but were included mainly because the Auto-Start ROM lacks them.

Another useful command is "memory dump," which displays the contents of memory as hex bytes and ASCII characters. Memory dump is activated simply by typing the beginning and ending address of the memory area you wish to examine. For each address, MON+ displays the address and the contents of the next eight bytes. This format is the same as for a memory store, hence it is easy to change a displayed portion of memory using cursor moves and the forward arrow to re-enter the line.

To prevent information from scrolling by too quickly when large portions of memory are displayed, a "key check routine" is automatically called. This routine periodically checks to see if a key has been pressed, and if it has, pauses the display until another key has been pressed.

Among the commands not available in the Apple monitor at all, we found the "XB" the most useful. This is used to boot 3.2 disks on a 3.3 system. However, if a 3.2 boot fails, it will automatically try a 3.3 boot. Having accumulated over a four-year period a substantial library of Apple disks, many of which are 3.2 and most of which are not identified as to which DOS they contain, I find the command most useful. For my use, XB, by itself, has justified purchase of the MON+ system several times over.

Another nice feature of MON+, when used with the Auto-Start ROM is that hitting reset enters the monitor instead of Basic.

It should be noted that entering and exiting MON+ is done either from the Apple monitor or from Integer Basic. When Applesoft (ROM or language card version) is active, calls to MON+ are not possible.

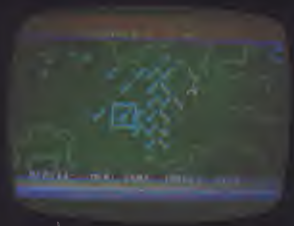
MON+ is available in one ROM chip which resides in the empty D8 socket along side Integer Basic; this version costs $49.95. It is also available on disk for the Apple II Plus with the language card or equivalent. This version updates the INT Basic file so that MON+ is loaded with Integer Basic when the system is booted. List price for this version is $39.95. MON+ is available from Microseeds, Lakeview Terr., Stafford, CT 06076. □

CIRCLE 353 ON READER SERVICE CARD

Table 1. Commands of MON+

command	syntax
Memory dump	*addr . addr*
Page dump	*addr* P
Store string	*addr* : " *char char ...* "
	addr : ' *char char ...* '
Addition	*addr* + *addr*
Subtraction	*addr* – *addr*
Single step	*addr* S
Trace	*addr* T
Move memory	*addr* < *addr . addr* M
Zap memory	*byte* < *addr . addr* Z
Search (hex)	*addr . addr* ? *byte b byte ...*
(ASCII)	*addr . addr* ? " *char char ...* "
(wildcard)	*wbyte* < *addr . addr* ? *byte b wbyte b byte ...*
Read from disk	*addr* < *track . sector* R
Write to disk	*addr* < *track . sector* W
Enter monitor	•
Addresses of BLOAD	XA
Boot 3.2 disk	*byte* XB
Catalog	XC
Connect DOS	XD
Free disk space	XF
Exit ***MON+***	XX

RISING STARS



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Casino Games For The Apple

Brian J. Murphy

Name your poison! Is it craps? Baccarat? Roulette? Poker? Keno? Blackjack? You can place $500 bets on any of these games, all night if you like, and never risk anything more substantial than the few cents of electricity it takes to run your Apple II with re-creations of the great casino games from Softape and Datamost.

Softape has four games currently on the market. They are *Roulette* and *Craps*, published in 1979; *Apple 21*, released in 1980; and *Draw Poker*, which came out last year. Softape was aiming for a detailed, highly realistic recreation of these games as played under casino rules, and they have succeeded quite well.

Draw Poker

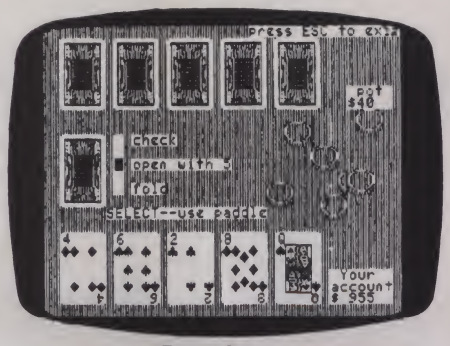
Starting with the best of the lot, *Draw Poker*, you have a game which plays well with good graphics, screen action and sound effects. Author Ken LaBaw has devised for this solitaire game a computer opponent with two personalities. One is that of a plodding, fairly predictable, conventional player. When the dealer discards three cards you can be fairly sure it is holding only a pair. When it discards four, you have, more or less, a sure win.

The second personality is not as predictable. From the way it bets you might think it was holding three of a kind or a straight and fail to challenge it with a bet, only to find that it was holding a pair. In short, it will bluff.

Brian J. Murphy, 133 Post Road, Fairfield, CT 06430.

creative computing
SOFTWARE PROFILE

Name: Draw Poker
Type: Gambling simulation
System: 48K Apple II, disk drive
Format: Disk
Language: Machine language
Summary: Great poker simulation
Price: $24.95
Manufacturer:
Softape
10432 Burbank Blvd.
North Hollywood, CA 91601



Draw Poker

Bets are $5 each and the ante is $20. Some of the nice features include the ability to cut the deck, an entertaining animated shuffle and a fine, hi-res shape table for the cards, designed by Bill DePew. *Draw Poker* is a fast-moving, amusing simulation which makes a good introductory level poker teacher.

Apple 21

DePew is the author of another Softape game, *Apple 21*, which realistically recreates blackjack as played in the casinos. As many as three players can challenge the computer dealer. The play begins with the ominous announcement that you are "tapped out."

The computer offers a loan of up to $1000. It was only after reminding myself that my Apple II wouldn't be sending someone around to break my arm if I lost it all that I was able to take the money and get on with the game.

In the computer "shoe" there is only one deck. It appears that the trigger for a reshuffle is the playing of the fourth ace. Once that ace appears there is a new shuffle, even if there is a hand in progress.

creative computing
SOFTWARE PROFILE

Name: Apple 21
Type: Gambling simulation
System: 48K Apple II, disk drive
Format: Disk
Language: Machine language
Summary: Good blackjack game
Price: $24.95
Manufacturer:
Softape
10432 Burbank Blvd.
North Hollywood, CA 91601

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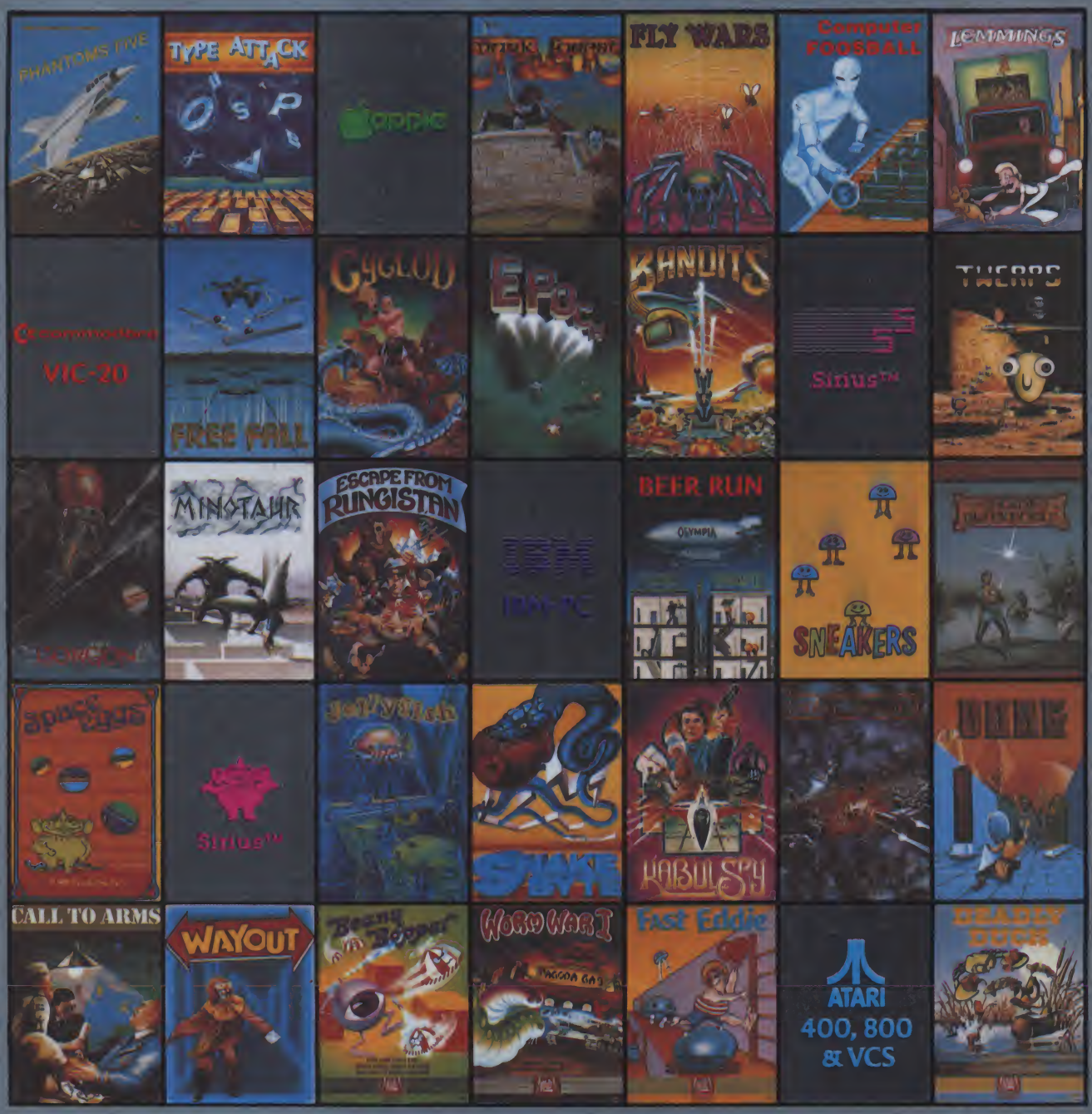

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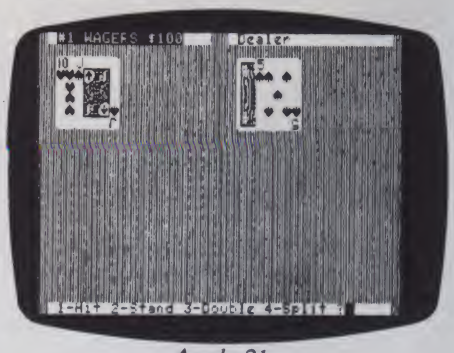


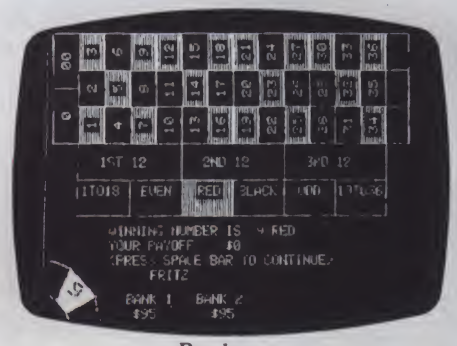
Apple 21.

Play is much the same as in the casinos. The dealer will hit on 16 and stand on 17. If the dealer's first card showing is an ace, you can buy "insurance." No running total of the players' card counts is kept on screen; that computing must be done via biological processing, but it's good practice for real life. Play is swift and exciting. The only drawback to the game, so far as I can detect, is that there is only one deck in play. This means the program does not provide the kind of experience aspiring card counters, who face three or five decks in the shoe at a real casino, would probably like. Of course there is a bright side: unlike a real casino, which will give you the bum's rush if they think you are counting, the Apple II doesn't seem to mind at all.

Roulette and Casino Craps

Roulette and *Casino Craps,* designed in 1979 by Roger Walker, are highly detailed and true to life simulations of the real thing. As in the actual casino games, there is very little strategy involved. What you need most to win is ESP.

In *Roulette* one or two players can challenge the computer "house." Each player starts with a $100 bankroll and can bet as much as $9. Using the Apple II arrow keys or a Softape light pen, you can place bets on any of 162 locations on the hi-res color playfield.



Roulette.

The rest of the game, of course, is sheer chance. The wheel spins and, depending on your gift for prophecy, you profit or crawl deeper into the hole. That is just one aspect of the realism of this game. With all the casino betting options available, even "system" players will find *Roulette* a good simulation of the real thing.

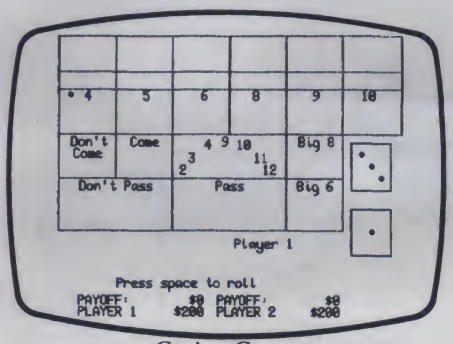
creative computing
SOFTWARE PROFILE

Name: Roulette
Type: Gambling simulation
System: 48K Apple II, disk drive, optional light pen
Format: Disk
Language: Machine language
Summary: Realistic roulette game
Price: $24.95
Manufacturer:
Softape
10432 Burbank Blvd.
North Hollywood, CA 91601

There is at least one heavy-hitting player who won't go to Vegas without his Apple II.

Casino Craps offers the same high level of detailed realism. All of the usual casino betting options are available for the player to choose, using the keyboard arrows or a light pen.

The one important area in which the program falters is its lack of documentation. For a beginner in the great game of craps there are no rules or instructions in print or on the screen.



Casino Craps.

creative computing
SOFTWARE PROFILE

Name: Casino Craps
Type: Gambling simulation
System: 48K Apple II, disk drive, optional light pen
Format: Disk
Language: Machine language
Summary: Realistic casino crap game
Price: $24.95
Manufacturer:
Softape
10432 Burbank Blvd.
North Hollywood, CA 91601

You must read Hoyle or Scarne for the rules and use your own common sense to figure out how to play the game. Once you get the hang of it the game moves along quickly like real crap shooting.

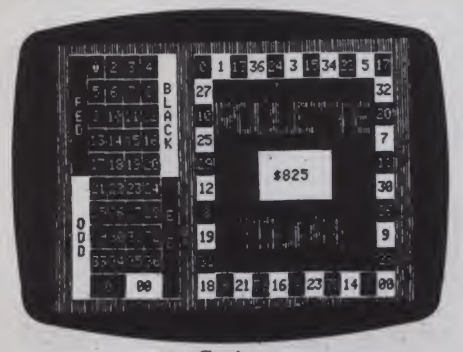
The realism of *Roulette* and *Casino Craps* is so great that, according to a source at Softape, there is at least one heavy-hitting player who won't go to Vegas without his Apple II and disk drive so he can play the games and keep sharp between sessions at the *real* tables.

Casino

The level of realism is not as high in Bob Rosen's *Casino,* published in 1981 by Datamost. Five games are offered, keno, poker, blackjack, roulette and baccarat.

Of the five, the best simulation is the blackjack game, which plays as smoothly as *Apple 21* although the hi-res graphics are not as attractive. The action moves swiftly and there is the added aid of a running count of your cards and the dealer's, to help speed up decision-making. The drawback, as with the other programs on this disk, is that the game is solitaire against the computer, making this program less of a party attraction than *Apple 21* and the other Softape casino games.

Keno is a pick the numbers game in which you have the opportunity to choose as many as 15 of 80 available numbers. The computer picks 20. What you win (or lose) depends on how many of the picks coincide. This action moves right along as does your bankroll in an outward bound direction.



Casino.

The roulette game is a little more exciting. The choices for betting are more limited than in the Softape version, but the action is a little faster and there is an added element of entertainment in the "roulette square" feature, in which suspense is heightened by a little cursor which spins around the square until, gradually slowing, it comes to rest on a number. This feature enlivens the game greatly and adds a touch of realism missing from the otherwise more sophisticated Softape game.

Realism is not the strong suit in the poker scenario. The screen shows five cards and the payoff begins with a pair of jacks or better. There is no strategy, other than choosing which three cards to discard, and no skill required, other than the ability to foretell the future. The game does move quickly, however, and players of slot machines may find it quite appealing.

Baccarat, the final scenario, requires even less skill than poker. The only decision you make is how much to bet. Once you have entered that information, the computer does the rest while you passively watch the fall of the cards.

creative computing
SOFTWARE PROFILE

Name: Casino
Type: Gambling simulation
System: 16K Apple II, disk drive, Applesoft
Format: Disk
Language: Applesoft
Summary: Five entertaining casino games
Price: $39.95
Manufacturer:
Datamost
9748 Cozycroft Ave.
Chatsworth, CA 91311

Casino has several nice features which help to emphasize the entertainment value of the programs. There is abundant use of music, which you have the option of turning off if you like, and a "stats" option which lets you see how well you are doing vis-a-vis other players. Your bankroll (you start with $1000) at the end of the game is recorded on the disk and if you take up the game at a later date you can, if you use the same name, start just as deeply in the hole as when you quit.

In all, Softape has the edge on realism. *Roulette* and *Casino Craps* are very detailed, realistic simulations but their entertainment value is not as high as *Apple 21* or *Draw Poker*, which is the best game of all the ones we have seen.

Casino is a good entertainment package, though with the exception of the blackjack scenario, it is not as realistic as the Softape games. All the games seem best suited for players with a prior interest in gambling. That audience should find these programs very satisfactory.

For beginning gamblers they offer a painless and relatively cheap introduction to games of chance and an opportunity to sharpen basic skills and to be reminded how stacked the odds are against anyone who gambles for real. □

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CIRCLE 195 ON READER SERVICE CARD

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SOFTWARE PROFILE

Name: Colorsoft Flight Simulator
Type: One-player simulation
System: 16K or 32K TRS-80, Color Computer with joysticks
Format: Cassette
Language: Extended Color Basic
Summary: For aviation fanatics only
Price: $11.95
Manufacturer:
Color Software Services
P.O. Box 1723
Greenville, TX 75401

Scott L. Norman

I'm nuts about airplanes. Always have been. I am also interested in making the most of the considerable graphics capabilities of my TRS-80 Color Computer. That is why, ever since I acquired my machine, I have been eagerly anticipating a really terrific aircraft simulation game—one with a decent instrument panel, coupled with an interesting out-of-the-cockpit view.

The view could be of a carrier, an airborne tanker, or enemy aircraft, if it were a war game, if it were a commercial aviation game, then it could be a view of a runway layout during a landing approach.

I'm still waiting. *Flight Simulator* isn't it. *Flight Simulator* is a representation of an instrument approach to an airport, all right, but the "instrument panel" consists of six little text boxes, and there is no view out of the cockpit—not even a representation of the cockpit.

It is actually quite dumb. The only thing is, you can crank up the degree of difficulty and give yourself a pretty fair workout, because after all you are trying to manage motion in three dimensions.

Your control of the aircraft is limited to climbing, diving, and banking via commands from a single joystick.

It can become something of a challenge to monitor the few "instructions," too, because the layout of the panel is screwed up. Then there is the matter of the response of the aircraft.

This is no F-15 you've got on your hands. It staggers through turns like a drunk finding his way out of the House of Mirrors, it drops alarmingly from high altitudes, and it floats when you want to lose the last few hundred feet before landing. I don't know what kind of aircraft it is supposed to simulate; I don't know if it obeys any control laws at all. Maddening.

Surprisingly, it isn't all bad, however. Let me describe the game, and let you decide for yourself. In *Flight Simulator*, the single player is first asked to specify an altitude and distance within which he must approach the airport in order to win. Both figures must be given in miles, although the altimeter readout on the panel is in feet as it should be. You can start with nice fat tolerances (up to 10 miles for an altitude specification, for instance!), but with a little practice you can be shooting for realistic goals. It is fairly reasonable to specify 0.1 miles for both dimensions; an altitude spec of 0.05 miles makes things a little dicey. After setting up your degree of difficulty in this fashion, you are presented with your instrument panel view, and the game begins.

The panel consists of three rows of data. The uppermost one gives you altitude and airspeed data and the compass heading; the next row gives the distance to the airport and something else, also called "heading," which is really the bearing to the airport from your Present Position. The third row consists of a fuel gauge.

The information is updated every two seconds. (The game is written in Basic, remember?) Your control of the aircraft

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is limited to climbing, diving, and banking via commands from a single joystick. Airspeed is controlled by the computer, and is reduced in two stages as you approach the airport.

All games begin with the aircraft at 30,000 feet and 220 mph, on a course of 270 degrees (due west). The airport is 300 miles to the north, and your fuel load is 10,000 lbs. (that's the way jets specify it, sport). Now things get a little complicated.

Your two-second updates actually represent a minute's flying time each at this stage, which makes the sluggish response of the plane even stranger. At any rate, your first task is to turn onto a course which will point you toward the airport. The quickest route is to execute a right turn through a little more than 90 degrees, which can be done with a fuel expenditure of about 2500 lbs. You can also go around the long way, turning left for about 270 degrees. This will still leave you with enough fuel, if you are careful.

You should also begin your descent during the turn. Part of the fun is experimenting with rates of descent during these early phases so as to leave yourself in a comfortable position for the rest of the flight. After all, you come out of your turn more than 200 miles from the airport, in general, and you don't want to fly it all at 500 feet.

Once you have established your initial course for the airport, you must continue to manage your altitude and correct any heading deviations that may occur. Occur they will, too. You will generally be unable to roll out of that first big turn right on the money, thanks to the control characteristics of the program, so you can expect to see the heading of the aircraft and the bearing to the airport diverge as the flight progresses. With experience, you develop a sense of which way to nudge the joystick to respond to such changes.

When you get to within 100 miles of the airport, airspeed is reduced to 180 mph. At the same time, the simulation rules are changed so that each instrument update represents 30 seconds of flight time.

Things change again when you are 20 miles out; airspeed goes down to 100 mph, while the simulated interval diminishes to 7 seconds. All of this is accompanied by additional audio tones at the two-second update intervals, together with some malarkey on the screen about being cleared to land on Runway 123.

Ignore the latter. Real runways are designated by a system related to their compass headings, and in this game the direction in which you finally approach the airport doesn't matter; only the distance and altitude count.

All of these changes in simulated time intervals make it difficult to develop a real feel for the flying characteristics of the aircraft, as I have stressed. The upshot is that in the latter stages of an approach, you must pay a penalty for any earlier mismanagement of the descent.

It is very common to find yourself closing rapidly on the airport with more altitude than you can shed, even with full forward stick.

Your only alternative at such moments is to overfly and go out on some course from which you can descend to a more appropriate altitude. The trick is to manage things so that you can later turn back onto a direct course for the airport. You need a lot of room in which to turn around, which means that it is necessary to go a good way past the airport before beginning your turn. Otherwise, you can find yourself orbiting the field, unable to ever get onto a direct radial bearing.

Nothing lasts forever, though, and your troubles will be over when you run out of either fuel or altitude (in contrast to the airman's classic trilogy of "airspeed, altitude, and ideas"). By the way, a crash for either reason is signified by a really annoying little tune.

That's really all there is to it. I must admit that successful "landings" came as a shock for a while, because they usually occurred while I was concentrating very hard on simultaneously maintaining a finite altitude and a small course deviation. *Flight Simulator* rarely gives you the luxury of flaring out for a proper landing.

So what's in it for the player? Not much, by objective standards. There are no graphics, you have no control over certain important parameters (ground-controlled airspeed?), and in my opinion the simulation as a whole is clumsy.

Of course, since it is in Basic the enterprising enthusiast could use it as the jumping-off point for his own game, but that's not much of a recommendation. I can't even say whether I would play it at all, if the numbers didn't purport to relate to an airplane.

Still, there is a certain satisfaction to be gained from flying a good pattern and glide path, even if there are no rewards within the game itself. In the end, such internal rewards are probably what attract people to any computer game. What can I say?

Buy *Flight Simulator* if you are an aviation nut, and join me in hoping for a really good simulation. Who knows, maybe the people at Color Software Services will be able to improve this one dramatically.

And if you do rework it, try to remember that any aircraft with a fuel load measured in pounds ought to have its airspeed measured in knots. □

CIRCLE 347 ON READER SERVICE CARD

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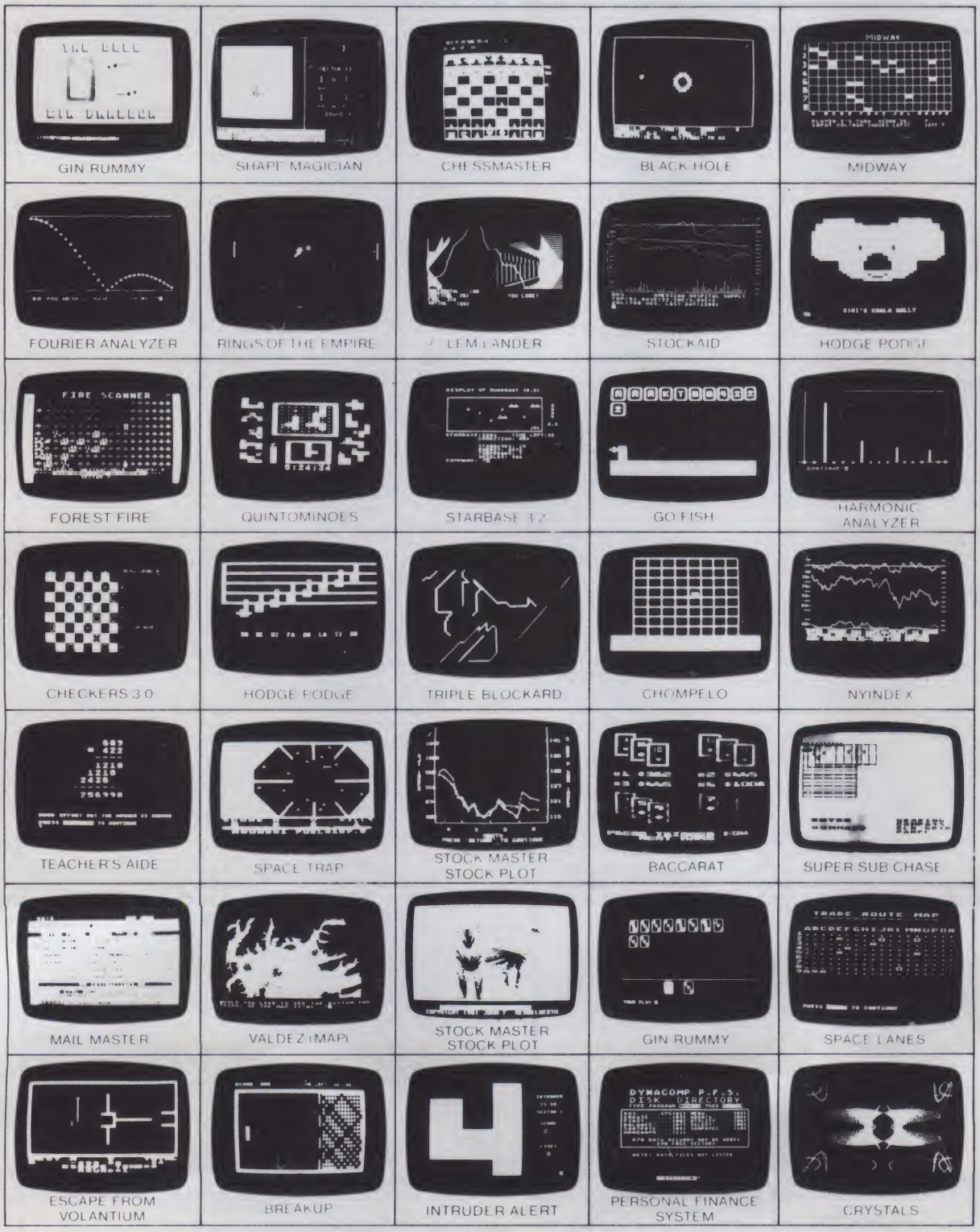

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This is the best micro computer implementation of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are superb. What else can be said?

POKER PARTY (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
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VALDEZ (Available for all computers) Price: $17.95 Cassette/$21.95 Diskette
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gull of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique, Personal Computing and Creative Computing.

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This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

NEW

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Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

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NEW

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AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level III), NEC and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM 3740 single density/double density compatible format) 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820, Heath, Zenith and many others). 5¼" CP/M diskettes are available for the North Star, SuperBrain and Osborne computer systems.

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***Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.*
****For most North Star disk-based systems.*
*****For Altair systems having Microsoft BASIC.*
******For SUPERBRAIN systems running under MBASIC or CBASIC (state which).*

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NEW

STARBASE 3.2 (Available for all computers) Price: $13.95 Cassette/$17.95 Diskette
This is the classic space simulation, but with several new features. For example, the Croylins now shoot at the *invincible* without warning while also attacking starbases in other quadrants. The Croylins also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Invincible is besieged by three heavy cruisers and a starbase. S.O.S. is received! The Croylins get even! See the software reviews in A.N.A./L.O.G., 80 Software Critique and Game Merchandising.

LIL' MEN FROM MARS (Atari only) Price: $19.95 Cassette/$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.

ALVIN (Atari only) Price: $17.95 Cassette/$21.95 Diskette
ALVIN is a great arcade game. You are commanding a highly maneuverable ship seeking to destroy several enemy cities. You are attempting to bomb these cities while at the same time trying to avoid their defensive fire (MISSILE COMMAND " in reverse?). Also, your radar has been damaged so that you can only see downwards. This would normally not be much of a problem except that you also have to contend with high-flying enemy aircraft. As long as you are above the aircraft you have the advantage and are safe. However, high level bombing takes considerable skill. Therefore to achieve your goal the best strategy is to swoop down for a bombing run while the enemy craft is out of range, and quickly retreat to the skies. A fun game. Requires 16K.

ESCAPE FROM VOLANTIUM (Atari only) Price: $15.95 Cassette/$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTIUM! To escape you must maneuver your space ship around obstacles and laser blast the guardian (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by repeatedly chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and guardians appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) Price: $13.95 Cassette/$17.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) Price: $14.95 Cassette/$18.95 Diskette
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) Price: $15.95 Cassette/$19.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

MIDWAY (Atari 32K only) Price: $14.95 Cassette/$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound are both included. Runs in 16K.

NEW

GOLF PRO (Atari only) Price: $17.95 Cassette/$21.95 Diskette
Both realism and beautiful graphics are joined together in GOLF PRO to produce the best golf simulation available. To really appreciate this game, you should have a color TV so that you can see the green of the fairway, the blue of the water hazards, and the white sand of the traps. You tee off with a wood, use your wedge in the sand trap, and putt on the green just as would be done on the course. Show off the Atari to your friends with GOLF PRO. Requires 16K and one joystick.

GAMES PACK I (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.
Why pay $9.95 or more per program when you can buy a DYNACOMP collection for just $14.95?

MOON PROBE (Available for all computers) Price: $12.95 Cassette/$16.95 Diskette
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) Price: $14.95 Cassette/$18.95 Diskette
This galactic "shoot 'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

SUPER SUB CHASE (Atari only) Price: $19.95 Cassette/$23.95 Diskette
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

TWO PLAYER GAMES

NEW

TWO PLAYER GAMES (Available for all computers; 32K disk/diskette only)
DYNACOMP has acquired the distribution rights to the best eight of Xitron's war games. These two-player games were originally written for the North Star computer, but have since been converted to play on all of the computers currently supported by DYNACOMP. Because our licensing and development costs were so low, DYNACOMP offers these programs two to a disk(ette) for only $19.95/diskette, $23.95/disk. If you like war games, then this is a bargain you can not pass up.

Set #1: PANZER and BLITZKRIEG
PANZER
Date: 23 Nov. 1943 Place: Several miles west of Kiev, Russia. The Russians have just liberated Kiev and are moving quickly to reach the German forces which are preparing for a last desperate attempt to halt the Russian advance.
BLITZKRIEG
Date: Spring 1940 Place: Northern France. The German blitzkrieg in the east was complete. Germany had turned its attention to the west: France. The German forces has penetrated the Ardennes and Meuse. The heroism of Dunkirk, the defense of the Aisne-Somme position, and the final collapse of the French armies in the south has all passed. And, now, the drive on Paris . . .

Set #2: STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE
STARSHIP TROOPERS
Date: Fortieth Century Place: Arachnid planet of Sheol. The first all-out battle on the planet Sheol which will match equal forces of Terran and alien units. The outcome will set the course of the conflict, for the planet of Sheol is a key position in the solar war.
INVASION OF THE MUD PEOPLE
A Peruvian army battalion has been dispatched to a remote village area to investigate the destruction of many local dwellings and the disappearance of most of the villagers. Eye-witnesses have reported strange creatures appearing from scores of slimy mud holes which have oddly begun forming across the terrain.

Set #3: FALL OF THE THIRD REICH and ARMORCAR
FALL OF THE THIRD REICH
Date: March, 1945 Place: Remagen, Germany. The allies under General Eisenhower had reached the Rhine. The Germans had failed in destroying the Ludendorff railroad bridge, allowing several allied divisions to cross before it finally collapsed on March 17 . . . and so, the allies began their drive on Berlin.
ARMORCAR
Date: 2 Feb. 1944 Place: Minsk, Russia. A German front-line unit is hard pressed for radio equipment and medical supplies. A relief convoy of armored cars must reach them through partisan-infested territory.

Set #4: MOUNT SURIBACHI and MIDDLE EARTH
MOUNT SURIBACHI
Date: 16 Feb. 1945 Place: Iwo Jima. The Japanese opened fire from Mount Suribachi as the marines landed on the porkchop-shaped island. Gunfire from the hill could cover the entire island, thus it was a critical objective if the Americans were to capture and utilize the all-important air field. Mount Suribachi proved to be one of the most strongly defended positions in the Japanese theatre of war.
MIDDLE EARTH
Date: 1997 Place: MIDDLE EARTH. Through a maze of tunnels, crevices, and rocky passageways discovered leading from an inactive volcano in South America, a team of United Nations' researchers have undertaken a mission to an uncharted frontier: the center of the Earth. After a perilous journey spanning a period of several months, the mission has arrived at the Earth's core, a land of flames, steam, oceans, and unforeseen vegetation. And then the creatures of MIDDLE EARTH appeared . . . unmatched by the most frightening horror stories created by man . . .

MISCELLANEOUS

CRYSTALS (Atari only) Price: $14.95 Cassette/$18.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.
Price: $9.95 each ($8.95 each [4 or more])
The complete collection may be purchased for $159.95.

NEW

5¼" DISKETTES (soft sectored/ten sectored) Price: $39.95/20 Diskettes
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

NEW

PORTFOLIO MANAGEMENT (Apple only) — Price: $69.95 two Diskettes

The PORTFOLIO MANAGEMENT package was written by a stock broker to help manage portfolios for individual customers. With this program data files can be easily created and kept up to date. A variety of reports can be generated for clients which are attractively and professionally laid out. The user may define his/her own investment catagories. PORTFOLIO MANAGEMENT is a top quality, professional tool which will not only provide you with new conveniences but will also serve to enhance your appearance as an efficient and up to date advisor to your clients. Comes complete on two diskettes along with a 30 page instruction manual.

NEW

PERSONAL FINANCE SYSTEM (Available for all computers) — Price: $39.95 Diskette

PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations. Contains high speed machine language sort. PFS has been demonstrated on network (CBS) TV!

FAMILY BUDGET (Apple and Atari only) — Price: $34.95 Diskette

FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

NEW

TEXT MASTER (Apple 32K, diskette only) — Price: $49.95 Diskette

TEXT MASTER is a general purpose text editor for the Apple II computer. It features powerful, English-oriented commands which permit the complete manipulation of textural information. The information treated may be correspondence, computer programs, data to be used by other programs, and more. TEXT MASTER also interfaces with any printer connected to your Apple. The minimum system requirements are 32K of RAM, Applesoft on ROM, at least one disk, and a lower case adapter. TEXT MASTER can process any length file segment by segment. Thus it is possible to process files as large as a diskette. Comes complete with an efficient 16 page manual. TEXT MASTER is equivalent in capability to many word processing systems costing 3 x or more in price. The commands available in TEXT MASTER are: COLLECT, USE, EXECUTE, NONUM, INSERT, MERGE, STOP, RENUM, DELETE, SAVE, COPY, FREE, REPLACE, WAIT, MOVE, LENGTH, LIST, RESAVE, CLEAR, AUTO, RETRY, APPEND, SET, MANUAL, CHANGE, SCRATCH, SHOW, CATALOG, MODIFY, COMPARE, NUM, DISPLAY, HELP.

INTELINK (Atari only) — Price: $49.95 Diskette

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a very smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

NEW

PAYFIVE (Apple II plus diskette, two drives required) — Price: $149.95

This is an enormously flexible employee payroll system with extraordinarily good human engineering features. PAYFIVE prints checks and compiles the required federal, state and local forms for up to 148 employees. The pay methods may be hourly, salary, commission or any combination. There are multiple options for pay periods, and they also can be used in any combination. PAYFIVE includes many other features and comes extremely well documented with a 200 page manual. The manual may be purchased separately for $30, and that payment later applied to the software purchase.

SHOPPING LIST (Atari only) — Price: $12.95 Cassette/$16.95 Diskette

SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

NEW

TAX OPTIMIZER (Available for all computers) — Price: $59.95 Diskette

The TAX OPTIMIZER is an easy-to-use, menu-oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum, and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

STOCK MASTER/STOCK PLOT (Apple 48K) — Price: $59.95 Diskette

This is a full-featured stock portfolio management and analysis system. Ten years of records on up to thirty stocks may be maintained. You may record prices, revenue, earnings/share, ROE, quarterly earnings and dividends, transactions, long/short term gains, P/E, indexes (DJI, S&P, NASDAQ) and MORE! You may plot (HIRES) the price history of any stock against any other, time, or the indexes. Portfolio value may be evaluated at any time. Comes complete with superbly written instructions and sample files on a second diskette.

TURNKEY AND MENU (Atari only) — Price: $17.95 Diskette

TURNKEY is a utility program which allows you to create autoboot/autorun diskettes easily. Simply load and run TURNKEY, load the program diskette to be modified, and answer the questions! The TURNKEY diskette also comes with DOS 2.0 and includes another program, MENU. MENU lists the contents of your diskette alphabetically, and permits the running of any BASIC program on the diskette by typing a single key. TURNKEY and MENU provide you with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) — Price: $29.95 Diskette

STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display point and figure charts, as well as bar charts with oscillators. You can also examine long term moving averages and on-balance volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 239 days x 16 stocks. Included are stock dividend and split adjustment capabilities. A very professional package!

NEW

NYINDEX (Atari only) — Price: $29.95 Diskette

NYINDEX is a comprehensive software package for storing, retrieving and plotting New York Stock Exchange information. The daily data treated includes the composite index, advances, declines, new highs and new lows. Graphical displays include the above plus the index oscillator, cumulative advances/declines and moving averages. Data entry and editing is easy. The diskette includes more than two years of daily data. NYINDEX is an excellent companion to STOCKAID.

PLAYER-MISSILE GRAPHICS TABLET (Atari only) — Price: $19.95 Diskette

The PLAYER-MISSILE GRAPHICS TABLET was designed to take the drudgery out of developing four color displays in GRAPHICS MODE 7. No longer will you have to read the locations of those tiny blocks on your graph paper and calculate PLOTs and DRAWTOs. With PMG you will be able to easily design colorful graphic displays with your joystick and save them on diskette for later recall.

LIFE CYCLE ANALYSIS AND DEPRECIATION (Apple diskette only) — Price: $39.95 Diskette

This software package creates a data file of business expenses for equipment which can later be used to calculate and display a variety of reports. You may project annual costs, find the present worth, create depreciation schedules and justify tax deductions. The evaluation techniques conform to standards set by federal agencies. This is an invaluable package for any businessman who has invested in equipment. LIFE CYCLE ANALYSIS features an easy to use data file creation section and provides formatted hardcopy reports for use in presentations or for tax record keeping purposes. When used for generating tax information, this package is tax deductible! Requires 48K. Comes on two diskettes.

NEW

MICROMAGIC (Apple diskette only) — Price: $39.95 Diskette

The emphasis of this program is clearly the MAGIC! MICROMAGIC offers outstanding versatility in its ability to function as a stand alone entertainment package or as a utility program to create stunning *animated* graphics for use in other programs. The secret lies in MICROMAGIC's special on screen graphics editor. You control a graphics cursor directly from the keyboard, creating high resolution images using all 16 available colors. When you are done with a picture, it can be saved on disk with a single key command. Up to 24 images can be saved as "frames" of a movie, and then played back at high speed to creat short animated sequences. The effects are truly stunning.

This package comes complete with demonstration programs so that even novice users can get immediate results. No programming skills are necessary to use MICROMAGIC. If you have been frustrated by the effort required to create graphics images with your computer, MICROMAGIC will delight you.

SHAPE MAGICIAN (Apple II, 48K, diskette only) — Price: $29.95

At last! An utility for painlessly creating graphics shapes for the Apple. Create, edit and save up to 30 shapes which can then be used to develop arcade games or to simply enhance your programs. Add that professional touch!

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card. Purchase orders accepted.

Shipping and Handling Charges
Within North America: Add $2.00
Outside North America: Add 15% (Air Mail)

Delivery
All orders (excluding books) are sent First Class.

Quantity Discounts
Deduct 10% when ordering 3 or more programs, 20% when ordering 5 or more. Dealer discount schedules available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star, Osborne, Superbrain and NEC format.

Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

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1427 Monroe Avenue
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24 hour message and order phone: (716) 442-8731
Toll free order phones: (800) 828-6772
(800) 828-6773
Office phone (9AM-5PM EST): (716) 442-8960
New York State residents please add 7% NYS sales tax

HODGE PODGE (Apple 48K only) — Price: $14.95 Cassette/$18.95 Diskette

Let HODGE PODGE be your child's teacher. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 7. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education. See the excellent reviews of this very popular program in INFOWORLD and SOFTALK.

TEACHER'S AIDE (Atari and PET only) — Price: $13.95 Cassette/$17.95 Diskette

TEACHER'S AIDE consists of three basic modules contained in one program. The first module provides addition and subtraction exercises of varying levels of difficulty. The second module consists of multiplication problems in which the student may be tested both on the final answer and/or on the subtotal answers in the long hand procedure. Several levels of complexity are provided here as well. The third module consists of division problems, one particularly nice feature of the division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate the procedure by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill, but rather a learning experience.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — Price: $39.95 Cassette/$43.95 Diskette

DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) — Price: $19.95 Cassette/$23.95 Diskette

This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) — Price: $19.95/$23.95 Diskette

This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) — Price: $24.95 Cassette $28.95 Diskette

HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage, retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $51.95 (three cassettes) and $63.95 (three diskettes).

REGRESSION I (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy, an automatic degree determination option, an extensive internal library of fitting functions, data editing, automatic data, curve and residual plotting, a statistical analysis (e.g., standard deviation, correlation, coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

PARAFIT is designed to handle those cases in which the parameters a imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data, results and residuals may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) — Price: $24.95 Cassette $28.95 Diskette

MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Not available on Atari cassette or for PET/CBM) — Price: $39.95 Cassette/$43.95 Diskette

In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{K-P} factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1
- Collection #1: Chapters 2 and 3 - Data and function plotting; complex variables and functions.
- Collection #2: Chapter 4 - Extended matrix and vector operations.
- Collection #3: Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.

Price per collection: $16.95 Cassette/$20.95 Diskette
All three collections are available for $44.95 (three cassettes) and $53.95 (three diskettes).

Volume 2
- Collection #1: Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
- Collection #2: Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.).
- Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
- Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
- Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
- Collection #6: Chapter 6 - Methods for finding the real roots of functions.
- Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
- Collection #8: Chapter 8 - Optimization by steepest descent.

Price per collection: $14.95 Cassette/$18.95 Diskette
All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).
Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP.

BASIC SCIENTIFIC SUBROUTINES, Vol. 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol. 2 (790 pages): $23.95 + $1.50 postage

See reviews in KILOBAUD, Dr. Dobbs, and ACCESS.

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NEW

BEAM DEFLECTION (Available for all computers) (disk/diskette only) — Price: $29.95 Diskette $32.45 Disk

BEAM DEFLECTION is the first in DYNACOMP's new series of structural analysis software packages. It consists of two programs. The first program permits the development of data files which describe the problem. For example, the ends of the beam may be pinned, clamped or free. The beam may be uniformly supported by an elastic bed, or held up by springs variously placed and having differing spring constants. The elasticity and cross section of the beam may vary along its length. The load may be uniformly distributed or it may include discrete forces. The beam may be pinned at various points along its length. And so on. All this information may be easily entered and edited using the data input program.

Following this the analysis program is called. The calculated results are the stress and deflections of the beam, both in numerical and graphical form, since the input data is saved, cases may be easily re-run with modification, thereby permitting iterative design.

The documentation which comes with BEAM DEFLECTION clearly shows how to use the software. In addition, three test problems are described and demonstrated to ensure that you understand how to use the program. Also, helpful theoretical information is supplied in the appendix.

STATTEST (Not available on Atari cassette or for PET/CBM) — Price: $19.95 Cassette $23.95 Diskette

This is a statistical inference package which helps you make wise decisions in the face of uncertainty. In an interactive fashion you can build and edit data files and test the differences in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. This menu-directed statistical workhorse is rounded out with a chi-square contingency test and a (uniform and normal) random sample generator. The documentation is written by a college professor who guides you through the various tests.

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Getting Iced

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SOFTWARE PROFILE

Name: Hockey
Type: Two player sports action game
System: Atari 400/800 16K
Format: Disk
Language: Machine
Summary: Achieves its goal
Price: $29.95
Manufacturer:
Gamma Software
P.O. Box 25625
Los Angeles, CA 90025

Norman Schreiber and Witold Urbanowicz

Hockey, by Gamma Software, is almost fast, never furious, and generally fun. That's what we—Witold, Norman, Roman and Jason—discovered one Stanley Cup weekend.

We loaded the game (which, by the way, requires 16K), powered up, and the screen beckoned with a menu of options—nine in all. (Game durations are three, five or eight minutes and two, three or four people can funnel their hostile energy into knocking a puck across the ice.)

Each game begins with the last tones of the "Star Spangled Banner," followed immediately by the roar of the crowd. It's four on four as one goalie and three free-skating forwards go against each other.

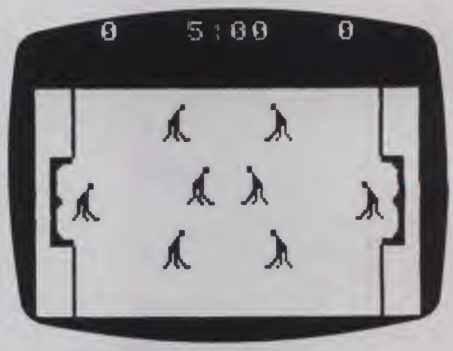
Using joysticks the human opponents manage the teams. With the three-player option two (one controlling the goalie) gang up on the third. Four-player play brings both goalies under joystick control. A scoreboard and clock sit at the top of the screen.

We first selected a two-player, three-minute game. The puck was dropped and the two center forwards, under joystick control, went into action. Each goalie's movement in front of the net corresponded with up and down movements of the joystick. The other four forwards moved as "smart" players.

The action was intense. The hockey puck slid and caromed across the horizontal ice, and the players scrambled to dominate the puck. Joystick control remained with the original two until the puck struck another player's stick. And *voila*, the joystick managed that player. When the puck was free, the joysticks controlled the original center forwards. This created opportunities for some fancy passing, a neat way to outsmart the opponent or even oneself.

Inevitably, the action brought the players, in one Gamma glut, directly in front of a net. A shot was taken. The goalie edged sidewards and successfully blocked. Another head-on shot brought another block. The next try started from the corner and homed in at a sharp angle. It whizzed past the goalie and the crowd roared. Players reassembled at center-ice for a new face-off. And so on.

At game's end, the score was tied, so we were thrown into sudden death overtime and given an additional three minutes. Unfortunately neither glorious team could score. There was no additional overtime, so we settled for a tie and celebrated with a rematch.



Gamma *Hockey* arouses competition. The four of us scarcely kept our tails upon our seats as we played the game at various angles of leanforwardness. The value of the three- and four-player options was that we adults could also get into the game, rather than just hover. Actually, the four-hand participation did make the game that much more exciting. It is unfortunate, however, that no solitaire option exists. One would like to get one's chops together in the quiet of one's own fantasies.

The two teams are blue and green; except on a black-and-white monitor in which case they are grey and grey. You can tell who is on first by the direction in which the hockey stick points. The thoughtful designer(s) made joystick-controlled players flash when the puck was free. However, the "smart" players tend to flicker as they move. Consequently, there was a certain amount of confusion at certain points.

Norman Schreiber and Witold Urbanowicz, 135 Eastern Parkway, Brooklyn, NY 11238

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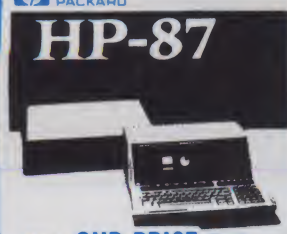

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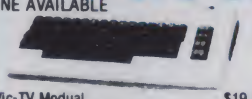

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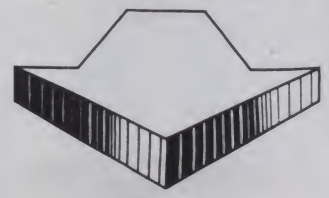

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Hockey, continued...

Perhaps the most intriguing, at least to reviewers, aspect of Gamma *Hockey* is the slow rate at which the players move speedily. Said nine-year-old Roman, "Can't you make them go faster?"

Said 35-year-old Witold, "It might have something to do with the horizontal movement of the game in what is basically a vertically-structured medium."

Norman, 41-years-old, observed that there was no way for players on one team to maim, destroy or righteously punish players on the other team. (This happens to be his favorite feature in the Activision VCS cartridge.) And 14-year-old Jason kept on scoring goals.

Something should be said for and against the sound. It keeps the game going and provides some pleasant texture for the ongoing battle. However, after playing 12 games, one gets to feel a bit unpatriotic at wishing the familiar notes of the national anthem would speed up radically (pardon the expression). Perhaps if there were a Kate Smith voice chip things would be different. Perhaps not.

The crowd noise, though useful, sounds suspiciously like our television sets at four in the morning when there's nothing to pick up but noise, and made us wish for a Dolby override.

We also should note that during one of our many games, four players suddenly disappeared. They could not be found. They certainly weren't in the penalty box. They just as mysteriously reappeared in a few seconds. We tried to render the hockey players invisible again; and failed. We haven't the foggiest notion why this happened. Not even Witold has a theory. Final note: The documentation is clear, concise, easy-to-read, and offers some useful tips.

Postscript: We had to go through all the options. After all, we decided, we really had to explore the game. We owed that much to our readers. We would have ended the tests sooner, but regardless of which time option we played, the final buzzer always went off too soon. ☐

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The Programmer's Guide to Programmer's Guides

George Blank

A major portion of any programmer's time is spent searching for information, trying to discover how something works, or even developing routines that are readily available elsewhere. A properly organized collection of the right reference manuals can increase his productivity substantially.

Some of the contents of the reference shelf are obvious. The programmer will want to organize the user's manuals that came with his equipment and systems software in order to have them within reach while programming. Space limitations will insure that the material that is seldom used will be moved to less valuable locations.

The most valuable reference guide I have is my own notebook. Whenever I write a subroutine, work out a procedure, or do any complex program, I write out the instructions, dump a listing, and file them in a notebook. Many of my programming friends do the same thing.

After that, there is a whole series of reference books that I consult. Many of them are incidental references, such as a programming text with some useful charts. Others are designed specifically to be used as reference handbooks. Since there are hundreds of references available, I will limit this review to software handbooks for popular systems.

George Blank, 239 Fox Hill Rd., Denville, NJ 07834.

The Basic Language

For most people, the best reference guide to Basic is the one that comes with their computer, or if Basic is not included, with their Basic. No general guide offers complete syntax for each computer. In my personal opinion, the built-in HELP command in TRS-80 Model III TRS-DOS from Radio Shack is better than a book. It gives clear and complete syntax. Other disk operating systems have offered help features for a long time, but I consider Radio Shack's the easiest to use and most complete.

The most valuable reference guide I have is my own notebook.

The best selling reference guide for Basic is David Lien's *The Basic Handbook*. The newly revised 2nd edition is greatly expanded, and now covers more than 250 dialects of Basic. The book describes Basic operators, commands, and functions one at a time, giving the purpose of the word, a test program and a sample run to see if it is implemented on your computer, variations in usage and alternate spellings on different computers, subroutines that you can use if you do not have the function in your Basic, and cross references to related functions.

This 480-page book is most useful to programmers who are converting programs from another computer dialect to their own. It is also helpful for people who want a general reference to Basic, or who work in several different Basic dialects. The most serious limitation of the book is that it does not give enough information on the graphics features of different Basics to help in converting programs that use graphics.

Pascal

Pascal is less fragmented into different versions than Basic, so a handbook can serve a broader purpose. *The Pascal Handbook* by Jacques Tiberghien describes every symbol, reserved word, identifier, and operator for seven different versions of Pascal, including UCSD Pascal. The 180 entries, in alphabetical order like *The Basic Handbook*, give a definition, a syntax diagram, a semantic description, implementation details, and program examples. This book is

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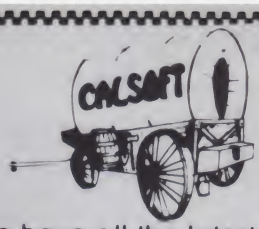

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particularly useful for beginners in Pascal programming.

The *Beginner's Guide for the UCSD Pascal System* by Kenneth Bowles is more of a teaching manual than a reference guide. However, the chapters are logically organized, the headings allow the reader to find topics easily, there is a good index, and the examples are clear and adequate.

Fourteen appendices describe the implementation of UCSD Pascal on different systems and terminals, summarize system commands, list error messages, and describe the differences between UCSD and standard Pascal. Anyone starting to use UCSD Pascal will find this book worthwhile.

CP/M

The popular CP/M operating system has a large number of commands and instructions. An excellent reference card is available free from *Microsystems*, a journal for CP/M and S-100 systems users. The CP/M Programmer's Reference Guide is a fold-out card that lists commands, PIP commands, parameters and keywords, control characters, assembler conventions and error codes, file types, DDT and Editor commands, IOByte functions, BIOS entry points, File control block, memory allocation, disk format, and BDOS function calls. *Microsystems* also offers similar free reference cards for Wordstar and Electric Pencil.

The *Osborne CP/M User Guide* by Thom Hogan and *The CP/M Handbook with MP/M* by Rodnay Zaks both combine material designed to teach the use of CP/M with reference material. I like the Hogan book better. It is more complete, uses less technical language, gives better explanations, and includes a good section on using popular high level languages and application programs with CP/M.

The Zaks book does have some advantages. It has a better layout, making it easier on the eyes and easier to find what you are looking for, and has a good set of appendices. Both books have decent indexes.

Apple II

Probably the handiest programmer's reference available is Computer Station's *Programmer's Handbook for the Apple*. This looseleaf binder has brief reference guides to Integer and Applesoft Basic, Pascal, Basic 80, Apple CP/M, 6502 Assembly Language, DOS 3.1, 3.2, and 3.3, the DOS Tool Kit, Applewriter, VisiCalc, Macro-Sced, Apple Plot, various printers, the Apple System Monitor, and hi-res graphics. Each reference is condensed to a few pages, and handy index tabs make the section you want easy to find. The binder is sturdy, and has plenty of room for your own notes.

An eccentric but useful reference guide for Apple II owners is Wozpak II.

Since this book, unlike Apple's spiral bound notebooks, is labeled on the edge and easy to find, most of the time I can find the information I need here in seconds instead of spending minutes to figure out which manual I need, trying to find the right manual, then trying to find the information I need. The material is condensed, and does not replace all other Apple reference manuals, but it is the first place to look for most questions about the Apple.

The *Apple II User's Guide* by Lon Poole and others is primarily tutorial, giving instruction in operating the Apple II, Basic programming, using the disk, Apple graphics, and using the machine language monitor and mini assembler. This is followed by 100 pages of reference material. There is a list of Basic statements and functions, a list of formulas for derived numeric functions, lists of editing commands, error messages, intrinsic subroutines in the ROM, useful PEEK and POKE locations, reserved words, and character codes. Memory usage and disk formatting is explained, and extensive conversion tables are included for hexadecimal/decimal number base conversion.

While the *Apple II User's Guide* is not laid out to give information at a glance, it does have a good index, and a great deal of good information, presented in a form that is easy to understand. Although there are a few technical errors, it is practically a must for Apple programmers. I consider this and its PET/CBM companion the most useful of all the books in this review.

Programmers working with DOS routines will find *Beneath Apple DOS* by Don Worth and Pieter Lechner, a valuable reference. It offers clear explanations, well illustrated, with detailed comments, on how Apple DOS works, how the diskette is organized and formatted, using DOS from assembly language programs, customizing DOS, and a breakdown of the logic of DOS by memory address in detail. There are several handy program listings, including utility programs for dumping tracks, updating diskettes, reformatting a single track, and binary file to text file conversion.

An eccentric but useful reference guide for Apple II owners is *Wozpak II* from the Apple Puget Sound user group. The primary limitation of this material is that it applies to Integer Basic only, and is of little use to Apple II Plus owners.

It contains a large number of useful assembly language routines to renumber, append, relocate, cross reference, and recover programs and pack, load, generate, and edit graphics. The Apple floating point arithmetic routines and the TED editor are explained, along with several other articles. Serious Apple assembly language programmers should have this book. The user

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group also publishes *CALL A.P.P.L.E.* magazine, and offers bound volumes of the magazine with indexes each year that contain a great deal of useful Apple reference material.

Programmers using the Apple Pascal system will find *Apple Pascal*, by Arthur Luehrmann and Herbert Peckham to be very helpful, but not a substitute for the *Pascal Handbook*. Luehrmann and Peckham write "this book is a dismal failure as a reference manual" (page 359) and then describe what a proper reference should offer. That description matches the Tiberghian book mentioned above. Despite the disclaimer, the book has a good index and clear explanations that are written specifically for the Apple.

What's Where in the Apple by William Luebbert is the best general reference to the contents of the various memory locations in the Apple II. It consists of three parts; a general overview of memory, an "Atlas" listing contents by memory address, and a "Gazetteer" cross-referencing symbol names to their memory location. The listings are not easy to read, as they are reproduced from a dot matrix printer in upper-case only.

PET/CBM

Osborne/McGraw Hill publishes the comprehensive, 500 page *PET/CBM User's Guide*. Chapters cover operation, screen editing, Basic programming, special features, cassettes, diskettes, and the printer. There is a good index and extensive reference material, including memory maps to the various ROMs, lists of Basic statements and commands, error messages, character codes, and editing functions. Conversion tables and a list of CBM newsletters and reference manuals are among the many other features. This is an excellent reference book.

TRS-80 Model I and Model III

There are several reference guides to the TRS-80 ROM routines, including *The TRS-80 Disassembled Handbook*, volumes I, II, and III by Robert Richardson, *Supermap* by Roger Fuller, *Pathways through the ROM*, which I edited, *The Book*, volumes I and II from Insiders Software Consultants, and *Microsoft Basic Decoded & Other Mysteries* by James Farvour.

The most recent, most expensive, and best of the lot is *Microsoft Basic Decoded*. This 300-page book begins with an introduction to the organization of memory in the Model I and a brief explanation of what happens in many of the key memory areas, including the communications area, arithmetic and math routines, I/O drivers, system utilities and other functions.

Chapter 2 lists over 80 useful ROM subroutines which are explained and described so that the reader can use them from other programs.

Chapter 3 describes cassette and disk operation, while the next chapter explains many of the internal tables in the ROM. The next chapter gives an assembly language program to add a SORT function to Basic. This is followed by a program demonstrating overlays in the memory communications area. The last 250 pages of the book disassemble the ROM and give comments to explain what is happening.

Bob Richardson is an amateur radio enthusiast, and the three volumes of *The Disassembled Handbook for TRS-80* contain quite a few programs he has written, many of interest to Hams. *Pathways through the ROM* includes two of the other books; Volume I of the *Disassembled Handbook* and *Supermap*. It also has comments on the DOS memory locations, which are not found in any of the other books.

There are two additional sources of valuable information on Radio Shack TRS-80 Model I disk operation. *TRS-80 Disk and Other Mysteries* by Harvard Pennington is primarily a guide to using disk modification utilities like Superzap, RSM 2D, Monitor 3, DEBUG, and Z80-ZAP to examine diskettes, recover data, and correct problems. It is very technical, but the disk user who is willing to work hard can learn a great deal from this material.

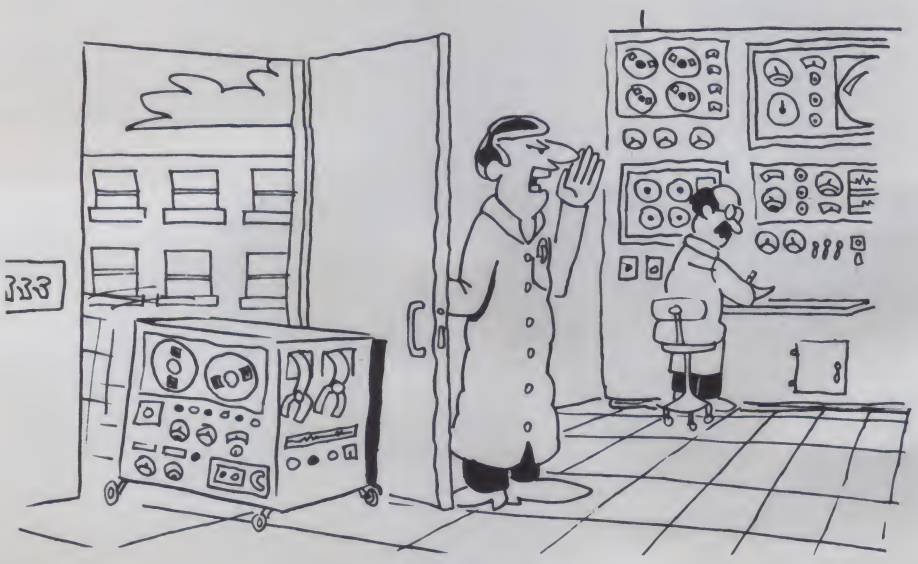
The other valuable disk reference is the *TRS-80 Model I Disk Interfacing Guide* by William Barden, Jr. This little 50-page booklet explains how a disk drive works, describes the Shugart disk drive and Western Digital controller chip used by Radio Shack, and gives and explains assembly language programs to boot, read, write to, and format a diskette.

This is the most helpful book available to assembly language programmers who want to write their own TRS-80 disk routines. However, assembly language programmers should be aware of the descriptions of DOS routines that are included in the Technical Reference section of Radio Shack's own DOS manuals. That information may be all that is necessary, and it was probably included with your disk system.

Atari

An excellent collection of simple Basic routines appears in *Atari Basic: Learning By Using* by Thomas Rowley. About two dozen programs illustrate graphics; sound; the use of paddles, joysticks, and special keys; as well as mixed modes; player missile graphics; and other special screen routines. Four short appendices cover key memory addresses, a player-missile memory map, building a display list, and calculating a screen position.

De Re Atari, from Atari, is a guide to the Atari computers for serious programmers. It gives a system overview, discusses and demonstrates display lists, character sets, player-missile graphics, display list interrupts and scrolling, then covers Basic, the operating system, and the disk operating system in detail. Nine appendices cover technical information, followed by a glossary. I would not recommend this book to anyone who did not have



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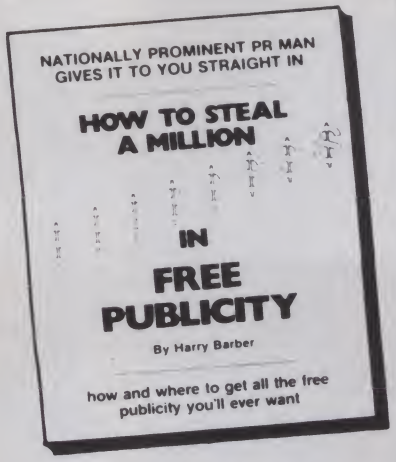

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a working knowledge of assembly language, as it is quite technical, and a great deal of knowledge is assumed. The lack of an index makes it difficult to use for reference.

Several chapters of the book have appeared in *Byte* magazine, beginning with the September 1981 issue. In general, the *Byte* material is edited, easier to read, and better illustrated. The same topics have been covered in more detail and assuming less special knowledge in "Outpost: Atari," in the June 1981 through January 1982 issues of *Creative Computing*. These columns have been collected and revised and appear in *The Creative Atari* from Creative Computing Press.

More Information

The Basic Handbook ($19.95)
David Lien
Compusoft Publishing
1050 E. Pioneer Way Dept. CC
San Diego, CA 92119

The Pascal Handbook ($18.95)
Jacques Tiberghien
Sybex, Inc.
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The Beginner's Guide for the UCSD Pascal System ($11.95)
Kenneth Bowles
Byte Books
70 Main St.
Peterborough, NH 03458

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Osborne CP/M User's Guide ($12.99)
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Osborne/McGraw Hill
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The CP/M Handbook with MP/M ($14.95)
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Programmer's Guide to the Apple II ($29.95)
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The Apple II User's Guide ($15.00)
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Osborne/McGraw Hill
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Apple Pascal ($14.95)
Arthur Luehrmann &
Herbert Peckham
Byte Books
70 Main St.
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Beneath Apple DOS ($19.95)
Don Worth & Pieter Lechner
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What's Where in the Apple ($14.95)
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Micro Ink, Inc.
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P.O. Box 6502
Chelmsford, MA 01824

PET/CBM User's Guide ($15.00)
Osborne/McGraw Hill
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Disassembled Handbook for the TRS-80
Vol. I $10, Vol. II $15, Vol. III $18
Robert Richardson
Richcraft Engineering
Drawer 1065
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Edited by George Blank
Softside Publications
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Tacoma, WA 98409

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Elcomp Publishing
53 Redrock Lane
Pomona, CA 91766

De Re Atari ($19.95)
Atari Program Exchange
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The Creative Atari ($15.95)
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CIRCLE 177 ON READER SERVICE CARD

TRON

THE MOTION PIXEL SHOW

Computer-generated motorcycles line up for a deadly race.

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Mike Coffey

I have seen the future of American film. It is computer-generated and wondrously vibrant. *Tron* takes the viewer inside the incredible world of computer graphics.

Walt Disney Productions has issued the *Wizard of Oz* of the 1980s. The story is of a young man, abused in this world, who suddenly finds himself fighting for survival in another. The other world is not over the rainbow, but behind the video screen. The characters he meets are not tin men and scarecrows, but programs.

Like *Wizard*, *Tron* starts out on earth. Our man Flynn, played by Jeff Bridges, has written several video game programs. Corporate villian Dillinger, played by dressed-for-success David Warner, has copied Flynn's programs and erased the originals. Due to the success of "Space Paranoids," the best of Flynn's games, Dillinger has risen to the top of the corporate ladder at Encom, and has banished Flynn.

One night, Flynn returns to the Encom computer to regain credit for his programming work. Dillinger, however, has installed a Master Control Program to thwart such damaging infiltrations.

With the help of two friends, Flynn reaches a privileged terminal and begins hacking away at the computer's security system. The MCP, like Oz himself, becomes angry as Flynn challenges it with unsolvable problems, and treats us to a dazzling laser light show as it dematerializes Flynn and draws him inside the computer.

Flynn's journey into the computer, like Dorothy's flight to Munchkinland, transports the audience into a world never before seen. The computer world of *Tron* is made of imagination and electrons, instead of papier-mâché and polyfoam. Time is measured in nanoseconds, and matter can be converted into energy at the drop of a disk.

Flynn's journey into the computer, like Dorothy's flight to Munchkinland, transports the audience into a world never before seen.

The programs inside the Encom computer have all been enslaved by the MCP. The MCP has decreed that people do not exist and that programs who still believe in users must be punished. The presence of Flynn, a rogue user, within the computer can only upset this agnostic algorithmic society.

The imprisoned programs are held in prison sectors with invisible force fields instead of bars. Each program awaits the time when he will have to prove himself on the Game Grid, where video games are played to the death.

Flynn's first game is a round of computer jai-alai, in which two video-enhanced players whip a synthesized fireball at each other. Whenever the ball hits the ground, it knocks out a section of the floor. Eventually, one of the players falls through the floor to his death. Flynn wins this game, but refuses to finish off his opponent. The MCP and Sark, his righthand man/program, become further enraged at this display of mercy and kill the loser anyway.

Next, Flynn must enter the light Cycle race/duel. Each player rides a motorcycle dragster that leaves a solid color wall in its wake. These cycles are computer generated, three-dimensional, blindingly quick, and impossibly agile. The bikes can make right angle turns at top speed.

The object of the game is simple: survive. Running into a wall made by a cycle results in instant dematerialization. Flynn and two others, Ram and Tron,

Sark holds a deadly disk.

With Sark and the MCP hot on their heels, our heroes finally reach the i/o tower and learn the secret that will enable them to humble the master program.

survive the race and manage to escape the Game Grid.

Flynn now joins forces with Tron, a creation of one of Flynn's friends in the real world. Tron and his creator are both played by Bruce Boxleitner. Tron's goal is to run independently of the MCP and to keep track of all interactions with other computers. Naturally, MCP discourages this, since his plans include stealing secrets from the Pentagon computer.

Flynn, Tron, and Ram begin a journey toward the input/output tower, where Tron must receive instructions from his user. Sneaking past armored tanks and hijacking a police vehicle, they make their way resolutely toward the tower as if toward the Emerald City.

Along the way, they meet a lovely female program played by Cindy Morgan, who also plays one of Flynn's real-life friends. Tron and this female seem to share a digital love relationship which causes Tron to react with jealousy when Flynn seems to recognize her. Anyway, she replaces the now deceased Ram in the traveling party.

With Sark and the MCP hot on their heels, our heroes finally reach the i/o tower and learn the secret that will enable them to humble the master program. They ride a solar simulator into the central part of the great computer where

The i/o tower.

the final battle must be fought.

A great electronic frisbee fight ensues, with Sark the first to fall. The battle lasts for several minutes before the good guys prevail and Flynn returns to the world of humans.

As the master is deprogrammed, a new light dawns on the computer world. Everything begins to glow in a fresh, new way and glorious sounds fill the air. All the programs run for their towers to communicate with their users once again.

Judgment

Though not a great example of film literature, *Tron* succeeds mightily as a computer graphics demo. The story is strictly Saturday matinee material, and the characters are shallow stereotypes like those found in TV situation comedies. However, for 16 quarters, I may return to see it several times.

The dialogue is peppered with computer in-jokes. As a former big-computer user and big-company employee, I enjoyed the rebellious anti-establishment flavor of the story. As a sometime programmer, I enjoyed hearing programs talk about users as if they were gods.

The great achievement of the film is the creation of a new world. The inner space environment is easily as convincing as the outer space environments of Kubrick or Lucas. It seems that the nightmares of the video game addict have been realized on film.

The message that comes through strongest is that brilliant people can do powerful things with computers. Flynn was able to thrill countless people with his video games, and Dillinger enslaved an entire company with his control program. The animation compares favorably with most of the "conventional" animation I have seen. The backgrounds and transitions in *Tron* are better executed than those in many Academy Award nominees.

No coin-op or home computer video game comes close to the effects of *Tron*. All those other graphic miracles exhibit a flatness that *Tron* has transcended. In my eyes, *Tron* makes *Close Encounters of the Third Kind* look like *Casablanca*.

The images found in *Tron* are close to the best available from computers anywhere. Some day, all computer games will have similar quality animation. If you want a preview of future film or future gaming, see *Tron*. □

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CIRCLE 229 ON READER SERVICE CARD

Pilot Tutorial I

M.R. Smith

This is the first of two tutorials designed to provide examples of uses of Pilot. Although it uses the Pilot-to-Basic translator which appeared in the October issue of *Creative Computing*, you can use it with other versions of Pilot. The tutorials are based on a workshop given at Calgary Teacher's Convention held in February 1982.

Type, Accept and Match

To type a message out to a student, the command TYPE (T:) is used before the message.

```
T:This lesson is on VOWELS

T:

T:What is your name?

T:
```

To make your screen easier to read, use T: without a message to print a blank line.

Once a question has been asked, the next step is to use the accept (A:) command to get the student's answer. The answer is automatically stored.

```
T:What is your name?

T:

A:

T:
```

Dr. Mike Smith, 304 86th Avenue SE, Calgary, Alberta, Canada T2H 1N7.

The answer from the student can be compared against what was expected using the match (M:) instruction. You can check against one thing or many things.

```
T:Type in this word  FRED

A:

M:FRED
```

or

```
T:Give me a vowel

A:

M:A,E,I,O,U
```

The modify instructions Y and N allow the courseware developer to do things depending on whether or not the last match instruction was successful. To do this simply add Y or N after the instruction T:, A:, or M:. For example, testing the vowels again

```
T:Give me a vowel

A:

M:A,E,I,O,U

TY:Very good that was a vowel

TN:No that was not a vowel.
```

Using the Y and N modifiers you can check a series of things. For example, suppose you are making a lesson to check on the use of the Pilot instruction T:

```
T:How would you get PILOT to write  WHO AM I

A:

M:T:WHO AM I

TY:RIGHT ON

MN::

TN:EACH PILOT STATEMENT MUST INCLUDE A COLON :

MY:T:

TN:THE TYPE STATEMENT MUST START WITH T:
```

In this short lesson, the first match instruction checked for the full correct answer. The second match instruction only occurred if the first match instruction failed. The third match instruction was made only if the second match succeeded.

The match instruction is both very powerful and very weak. For example, a single match instruction can be used to pick up any of the following words: yes, yep, yessir, yer, okay, OK, okey.

```
T:DO YOU UNDERSTAND?

A:

M:Y,OK
```

The Y in the match instruction will be matched against the Y in the other words, and the OK will be matched against even the misspelled word "okey." That is the powerful part. The weak part is that a match will also occur with the Y in the student's response NO YOU TELL ME.

To avoid this sort of problem, match against enough of the student answer to avoid this ambiguity but don't match against so much that the match instruction might not be able to spot a correct student answer.

For example using

```
M:YE,OK
```

would be good as it picks up the answers you want and ignores the one you don't want.

```
M:YES,OK
```

is poor. It marks some of the student responses incorrectly wrong.

Long Lessons

When building a very long lesson, many problems can crop up. The first is that you may not remember what each part of the lesson does. The second is difficulty in altering the way in which the student does the lesson. The first problem can be alleviated by documentation, and the second by splitting the lesson into parts.

The remark (R:) command is used to document things that the developer would like to remember. The student doing the lesson does not see the remark. It is simply a programming aid for the developer.

To break the lesson up into parts, use the lesson part (*:) instruction. The name of the lesson part is placed alongside the *:. At the very end of all the lesson parts the end (E:) instruction must be placed.

An example of these three commands is given below

```
*:LESSON 1

R:THIS IS A LESSON ON VOWELS

...

...

...

*:LESSON 1 PART 2

R:USING THE LETTERS BETWEEN A AND E

...

...

...

*:LESSON 1 PART 3

R:ETC.

...

E:
```

The jump (J:) instruction allows you to move about the program. For example, J:E allows you to jump to the end of the program and J:LESSON 1 PART 2 causes LESSON 1 PART 2 to be performed.

Using the jump instruction this way is rather restrictive. Instead the jump, match and accept instructions can be combined to move about the lesson according to what the student is doing. For example, this program shows the J: instruction being used to give the student a choice of lessons:

```
*:START

T:WHAT LESSON WOULD YOU LIKE?

T:VOWELS OR NUMBERS?

A:

M:V

JY:VOWELS

M:N

TN:ENTER VOWELS OR NUMBERS

TN:TRY AGAIN

JN:START

*:NUMBERS

R:LESSON ON NUMBERS

...

...

J:START

*:VOWELS

R:LESSON ON VOWELS

...

...

J:START

*:END
```

The first match/jump pair checks to see if the lesson VOWELS has been chosen. The second pair ensures that the student typed in a valid answer. At the end of each lesson part, a simple jump instruction takes the student back to the start of the lesson for another choice of topics.

Part Two of the tutorial will appear in the December 1982 issue of *Creative Computing.* □

SINGLES' NIGHT AT MOLLY'S

By Norman J. Wazaney Jr.

You never dreamed Solitaire could be so fascinating.

Solitaire in a saloon can be fun but it's better on your Apple*. Fair warning: if you get hooked on Solitaire, beware of this game! "Singles' Night at Molly's" is actually two basic solitaire card games with several variations permitting you to use the skill level and strategy you enjoy most. Play alone or against other players, where a rating system declares the winner. Features High Resolution color graphics, full user documentation and various scoring potentials.

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CIRCLE 279 ON READER SERVICE CARD

Logo Ideas

Robert Lawler

The Clever Hack and Clever Tactics

Two children played a simple Logo game, SHOOT. In that game, the turtle first draws a circle on the video display then, the pen is lifted and the turtle is set down at a random screen location. The objective of the game is to turn the turtle with RIGHT and LEFT commands until it points at the target then SHOOT the turtle forward into the target. When SHOOT is executed, it first moves the turtle forward the specified number of turtle steps. SHOOT next computes whether the turtle has landed within the circumference of the target. If so, a point is scored, the screen is cleared and a new round begins. Otherwise, the turtle is returned to its initial location and orientation.

This is a simple, low pressure game, used to familiarize new Logo people with the commands of the language. But with these two children taking turns at one terminal, the game quickly became competitive. It became important to score every time SHOOT was executed (they counted SHOOT executions as the basis of turn taking). One child noticed that the turtle always drew the target at the center of the screen. He also knew that the HOME command puts the Logo turtle at the center of the screen (and thus at the target center). He proceeded to score every time with the command sequence [HOME SHOOT 0], despite the outraged complaints of cheating from his opponent. This solution to the SHOOT problem is a clever hack. A "hack" is an accidentally effective way of getting around a particular problem.

The child's clever hack was easy enough to render ineffective. Someone else had only to change the game so that the turtle drew the initial target at another location for the clever hack to become worthless in itself. And yet, this clever hack served well as an example of a more general form of solution the child developed. He developed what he called a "clever tactic." Knowing that the SETHEADING command could point the turtle in a specific direction, he used SETH 0 then moved the turtle forward or back as necessary to align it horizontally with the target. A RIGHT or LEFT 90, with more forward and back commands would always then put the turtle within the target and permit SHOOT 0 to bring a certain score.

Summary

It is useful to distinguish between specific solutions to a problem in a particular circumstance and general solutions to all problems of a given class. Never despise the particular solution, however, for it can show the way to a more general and more powerful solution.

Robert Lawler, Centre Mondial Informatique Et Resources Humaines, Paris, France.

Advice To A Teacher

I write here about my own experience and out of that experience, but my situation is probably different from yours. You have had to worry about instructing 20 or 30 children. I have merely had to play with two children — and those children were my own whom I knew well. I write here also with the conviction that your work in the future will be more like my experiences than it has been. Computers will permit the construction of intellectual worlds where children will be able to spend much time learning effectively on their own. This will give you more time to know individual children and to intervene in their learning as the advisor you, their parents, and the children, themselves, hope you will be.

Geometry has been an important central theme of instruction in our laboratory because its founder invented a kind of geometry for children. We have called it "turtle geometry." It is distinguished from other geometries because it is a geometry of action. The leading actor, the agent of this action, is the turtle. Either a mechanical robot or a triangular cursor on a video display screen, the turtle goes forward some distance or turns through an angle on command. When its pen is down, the turtle draws a line.

At the ages of six and eight, my children were introduced to SHOOT, a simple turtle geometry game. A setup procedure drew a target and placed the turtle at some random screen location. To score, the children had to turn the turtle right or left some angle to point it at the target then SHOOT forward some distance into the target. The game was easy for them to play and they enjoyed it. (They even played the game without the computer; setting a hula hoop on the floor for a target, the children took turns playing turtle and keyboard commander.)

Robby, the older child, came to want a more complicated game. He was fascinated by the air battles of World War II and asked me to make a game in which the targets would be airplanes. READY-AIM-FIRE (we called R.A.F.) satisfied him; even more, it engaged him. Robby spent the better part of an entire day trying to score more kills than von Richthofen, the famous Red Baron of World War I. This game permitted him to do something he wanted — play in his own fantasy world. It permitted me to introduce him to absolute coordinate geometry.

The AIM procedure required specification of the location of the airplane through naming its X and Y coordinates. (Axes provided a scale from which these values could be read.) After the location of the plane was specified, the AIM procedure moved the "gunsight" to the location. AIM could be executed as many times as necessary to get the gunsight on target, where FIRE would destroy the plane and increase the score. When Robby later wanted a similar game for sinking ships, I showed him how to modify the R.A.F. procedures so that he could replace the gunsight with a sub and the airplane with a carrier, both simple drawing procedures he had created.

The style of introduction presented in this story is opportunistic in the extreme. It depends on three things: the inclination of the child to connect his computer activities with what he knows about other things that concern him; the flexibility of computer systems to enable the building of simple models; the knowledge and values of a teacher in shaping particular procedures through which the child's objectives are achieved in such a way that he is introduced to important ways of looking at and describing the world. □

The Countess And The Computer Language

Part One

Geoff Gilpin

Picture courtesy of Camelot Publishing Company.

This is the first of a three-part series on Ada. The first two parts comprise a tutorial on the language. The third is a comparison of two implementations of Ada for the Apple. Read on. The Countess is waiting.

Imagine that you are a computer programmer working for the Air Force. While assigned to the Cruise Missile Project, you come up with an especially clever program that makes the guidance system of the missile more accurate. You show the program to your boss who claps you on the back, gives you a raise, and then says:

"Hey, I just remembered—the Navy has cruise missiles too. Why don't you show them your program?"

So you walk across the street to see your friend Al, who works in Navy Data Processing. Al is very enthusiastic, but there is a problem: your program is written in Fortran and all of the Navy's programmers use assembly language. Since the Pentagon is interested, however, you and Al take several weeks from your jobs and translate the new program from Fortran into assembler, wasting a great deal of the taxpayers' money and seriously straining your friendship.

Now take the above scenario, multiply it by a thousand, spread it over decades, and you will begin to hear a clamor of tongues babbling away in military computer systems.

In 1975, the Department of Defense decided that this Tower of Babel had been built high enough. They formed the United States High-Level Language Working Group (whew!) to design a single language to be used as a standard among all branches of service. We now have the result of their labors—Ada, the universal language of the eighties.

Ada is named after Augusta Ada Byron, Countess of Lovelace, the nineteenth-century British noblewoman who worked with early mechanical computers. She is widely accepted as the world's first programmer and is regarded as a patroness by some members of the profession.

Geoff Gilpin, 1018 N. Leminwah St., Appleton, WI 54911.

Ada (the computer language) comes into the world propelled by enormous political and economic forces. When you apply for a job five years from now, your prospective employer will ask you if you know Ada, just as they ask about Fortran and Cobol now. This makes me very happy because I am a big fan of Ada (both the Countess and the computer language). I am here today to let you in on the ground floor, to give you a head start with programming in Ada.

When you apply for a job five years from now, your prospective employer will ask if you know Ada.

But first, a disclaimer: What follows is a description of the Ada language itself. Details concerning the creation, maintenance, and execution of Ada programs will vary between computer systems and are not discussed here. I am also assuming that the reader has some familiarity with at least one high-level "structured" language such as PL/1, C, Pascal, or even structured Cobol. Beyond that, things will be very basic. So, are we ready?

Here is a genuine Ada program, ready to run on that hot little microcomputer you have:

```
with TEXT_IO; use TEXT_IO;
procedure FIRST_EXAMPLE is

begin
put ("The Countess of Lovelace welcomes you!");
end FIRST_EXAMPLE;
```

This is a trivial little program that will, when compiled and executed (see your manual), print Ada's greetings on your terminal (or printer or whatever your "standard output device" is). Although trivial, this program has several things to teach us.

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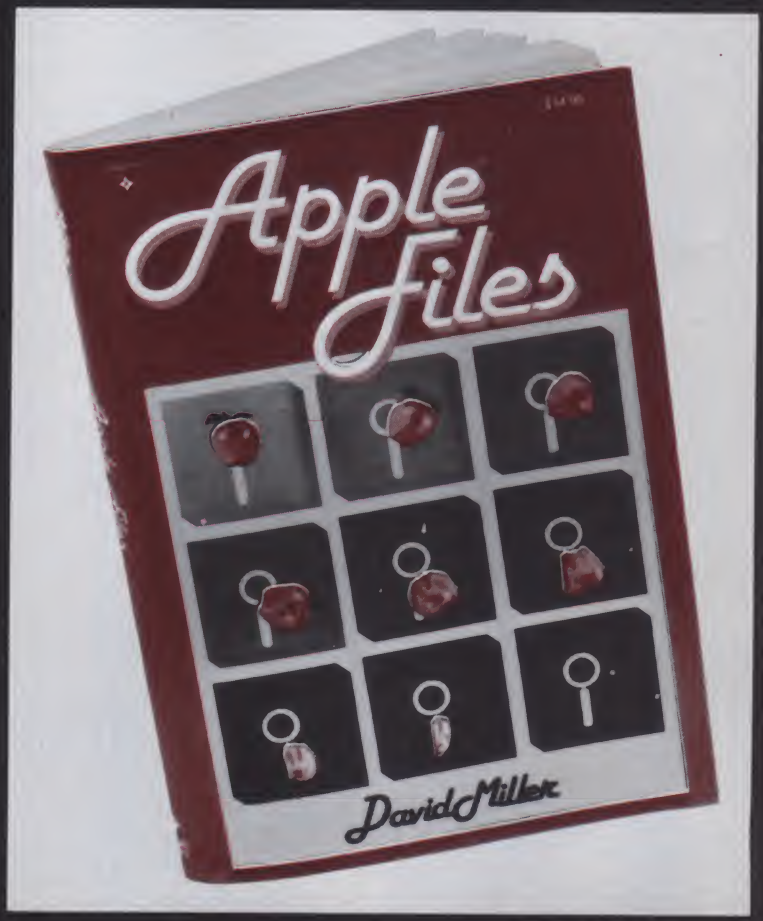

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CIRCLE 265 ON READER SERVICE CARD

Procedures

First, Ada programs have names. The one above is called FIRST EXAMPLE. It is an instance of a *procedure*, a simple kind of program unit in Ada.

Procedures begin with the keyword "procedure" followed by an identifier, which is a unique combination of letters, numerals, and the underscore character. Ada adheres to the custom of beginning an identifier with a letter. Here are some examples of Ada identifiers:

```
X, x, T1, Fred, day_of_week, ROTATE, abort_mission,

R97z33, oh_my_stars_and_garters
```

Obviously, meaningful names are better.

Procedures in Ada don't operate in a vacuum; they live in a particular environment. The environment occupied by FIRST_EXAMPLE is, in part, defined by the statements "with TEXT_IO" and "use TEXT_IO." Just as the citizens of a particular country have certain privileges and responsibilities, Ada programs operating in a specified environment acquire the features and limitations of that environment.

Specifying "with TEXT_IO" makes all the features of the TEXT_IO package (more on packages later) available to FIRST_EXAMPLE. Specifically, these include other Ada procedures designed to move streams of characters between the computer and various peripheral devices (the terminal, for instance). The "put" statement invoked in the fourth line of the program is actually an Ada procedure contained in TEXT_IO. If we hadn't specified "with TEXT_IO," the put procedure wouldn't have been available to our sample program, which would have been deaf and blind to the outside world.

Notice that a blank line divides FIRST_EXAMPLE into two logically distinct parts. The top two lines are called the "specification," which gives the information needed to link FIRST_EXAMPLE up to its environment. The bottom three lines, called the *body*, lists the actions performed by FIRST_EXAMPLE when it is invoked.

The body of FIRST_EXAMPLE contains a single command, the "put" statement, bracketed by the "begin" and "end" statements which delineate procedure bodies (and the bodies of other program units such as packages). Notice that the name of the procedure must be repeated after the concluding "end." This helps to keep the boundaries of the procedure clear.

Second Example

Since our sample program was so simple, let's look at another example:

```
with TEXT_IO; use TEXT_IO;
procedure SECOND_EXAMPLE is

NOT_PRIME: Boolean;
TWO:       constant := 2;
NUMBER:    integer;
REPLY:     character := 'y';
MESSAGE_1: string (1..14) := "Lady Lovelace ";
MESSAGE_2: string (1..17) := "bids you farewell";

begin
put ("enter an integer and I will tell you");
put (" if it is a prime number.");

while REPLY /= 'n' loop     -- /= means "not equal to"
      get (NUMBER);
      NOT_PRIME := false;

      for i in TWO..NUMBER/TWO loop
          if NUMBER mod i = 0 then
             NOT_PRIME := true;
             end if;
          end loop; -- for loop

      if NOT_PRIME
         then put (NUMBER); put ("is not prime");
         else put (NUMBER); put ("is prime");
         end if;
         new_line;
         put ("do you want to do it again?");
         get (REPLY);
         end loop; -- while loop

   put (MESSAGE_1 & MESSAGE_2);
   end SECOND_EXAMPLE;
```

So far, Ada looks pretty conventional. In fact, you Pascal users may be having a sense of *deja vu*. This is not a coincidence; the Department of Defense used the Pascal language as a model in the design of Ada and, apart from minor syntactical differences, Pascal can be considered a subset of Ada. Pascal programmers will notice that semicolons are used more consistently here. As in PL/1, semicolons terminate rather than separate statements. Semicolons appear at the end of nearly all statements; the major exceptions being is, begin, and loop.

SECOND_EXAMPLE is one step above the first program on the simplicity scale. When executed, it will determine if numbers entered by the user are prime; although its real purpose is to give an appreciation of the general structure of Ada. We will take a quick look at it to familiarize ourselves with the basic syntax of Ada and then move on to new territory.

The data declaration section, immediately below the specification, introduces a few of the familiar faces from Ada's great cast of data types. Notice that TWO is declared a constant, a value which does not change during the execution of the program. Initial values may be assigned to data objects, as occurs with TWO and the character variable REPLY.

We could have specified the type *constant integer* for TWO, although the type is implied from the assigned value. If the value had been 2.0 instead of 2, TWO would have been of the type *float*.

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Next there are the two MESSAGE strings. Strings in Ada are declared as arrays, with upper and lower bounds specifying the number of characters the string may contain. There is no "dynamic length attribute" as in Basic—a 14-character string must hold 14 characters.

In the assignment of the MESSAGE variables, notice that the assigned strings are surrounded by double quotes as opposed to the single quotes used to assign the character value 'y' to REPLY.

The main part of the program is contained inside the *while* loop that starts after the third blank line. Here we meet our first Ada comment, which begins with the "—" marker and extends to the end of the line. There are no embedded comments as in PL/1 and Pascal.

After the get statement (also part of TEXT IO) comes the Ada version of the iterative for loop, which is the biggest departure from conventional syntax that we have seen so far. Instead of assigning upper and lower values to an index variable, Ada uses a *range*. Ranges occur all through Ada and can be specified in different ways.

The simplest way, illustrated here, is to put two constants, variables, literals, or expressions on either side of two dots, the lesser-valued one on the left. For instance, we might have

```
for j in 'a'..'z' loop   -- the alphabet is predefined
```

or

```
for HUE in RED..YELLOW loop
```

Although it is not obvious from the above fragments, loop counters, such as j and HUE, are not explicitly declared with the other variables in the program. When j appears after the for keyword it is implicitly defined as a variable of type character. An explanation of the second example, and more concerning ranges, will appear momentarily.

Examining the for loop and its inner if statement reveals that Ada handles block structure differently from other Algol-related languages. Compound statements must be explicitly terminated, as in "end if" and "end loop." Although this seems clumsy when the compound contains only one statement, I prefer it to the endless BEGIN-END blocks in Pascal and Algol.

Farther down, in the second if statement, we come to one of the genuine shortcomings of Ada. Notice the two put statements required to print NUMBER and a message string. Any other programming language (even Basic), would have allowed you to write "put (NUMBER, "is prime")." Not Ada. NUMBER is a number and "is prime" is a string and put will only accept one type at a time. This makes formatting output extremely difficult, a fact which may slow acceptance of the language by the business community. Fortunately, Ada is designed for easy expansion and better I/O facilities should appear shortly.

The & in the final put statement is a concatenation operator, used for glueing strings together. The output will be

```
Lady Lovelace bids you farewell
```

with no surrounding quotes.

Control Structures

Before considering the more esoteric features of Ada, let's look at a couple of garden variety control structures.

Ada has a *case* statement which looks like this:

```
case NUMBER of
     when 0      => put ("NUMBER equals zero");
     when 1      => put ("NUMBER equals one");
     when 2|3    => put ("NUMBER equals two or three");
     when others => null;
     end case;
```

Notice the vertical bar used to separate alternative cases; the *others* clause used for cases not covered by the preceding *when* clauses; and the special *null* statement indicating that

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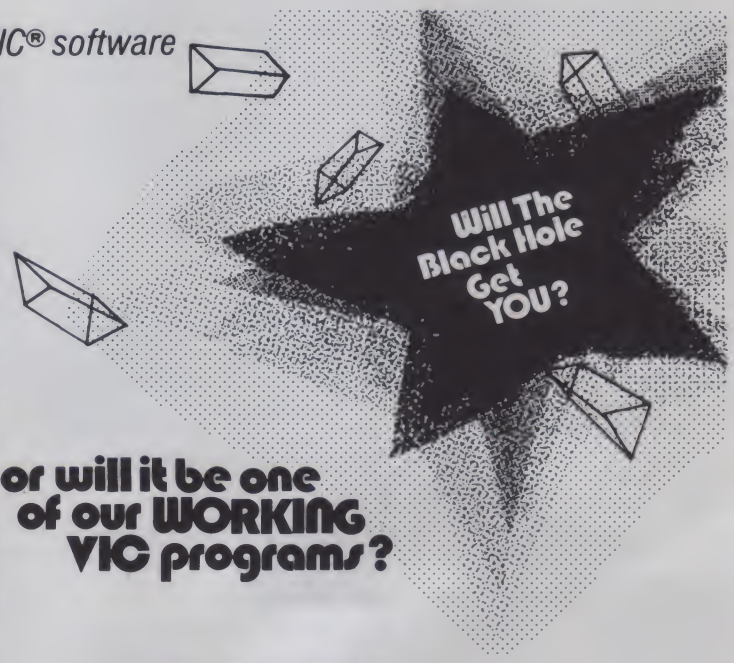

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nothing is to be done if NUMBER is greater than three or negative.

There is also a special *elsif* construct designed to take the messiness out of nested if statements, e.g.:

```
if    SCORE >= 90 then put ("grade: A");
elsif SCORE >= 80 then put ("grade: B");
elsif SCORE >= 70 then put ("grade: C");
elsif SCORE >= 60 then put ("grade: D");
                  else put ("grade: F");
end if
```

This lets us get by with a single "end if" and eliminates the dangling else that you sometimes see in languages like PL/1. By the way, out of 62 reserved words in Ada, *elsif* is the only one that is not genuine English.

So much for basic syntax. From now on, things begin to get very baroque very quickly.

Consider data types and structures. In addition to the types mentioned above, Ada has short integers, integers, and long integers; naturals and fixed point numbers; floats (three kinds) and reals—all of which can be altered *ad infinitum* through the use of various ranges, subtypes, and modifiers. (And those are just the numbers.) For instance, the declaration

```
NUM: integer range 1..10;
```

makes it illegal to assign NUM any value outside the specified range (which is handy for array subscripts.) If you are not happy with the integers that Ada gives you, you could declare

```
type MY_INTEGER is new integer;
```

which introduces user-defined data types (preceded by the keyword *type*), and derived types (specified by *new*). Now your integers can do everything that Ada's can, except mingle with other integer types. For example, the statement

```
X: integer;
Y: MY_INTEGER;

   ...

X := Y;
```

would produce an error message. This is because Ada is a "strongly typed" language. Variables of one type are totally segregated from those of other types. To get around this, Ada provides a conversion mechanism. The statement

```
Y := MY_INTEGER (X);
```

will take the variable X (an integer), convert it to the MY INTEGER type, and assign it to Y.

User-defined types do not have to be derived from the existing ones. If you want COLORS that can be RED, BLUE, and YELLOW, why settle for integers that can only be numbers? Instead, write

```
type COLOR is (RED, BLUE, YELLOW);
```

which permits declarations such as HUE: COLOR; and statements such as HUE := BLUE;. These new types are called *enumeration types* because the user must enumerate the values that variables of the type can have.

Sometimes we want to test whether a particular value belongs in the list of values of an enumeration type. This is called the *set membership* test and Ada provides a special *in* operator for the purpose. For instance, the declaration

```
type ADA_QUALITIES is (STRONG_MINDED,
                       FIERCELY_INDEPENDENT,
                       HAUNTINGLY_BEAUTIFUL);
```

allows us to test

```
if MEEKNESS in ADA_QUALITIES
   then put ("she was meek");
   else put ("no she wasn't");
   end if;
```

which will print the latter message.

There are many other data types in Ada, including *task* types (for concurrent programming), *private* types (for hiding data), and *access* (pointer) types. Are you getting the idea that Ada is *big*? You are right. Now on to data structures.

Data Structures

Ada has arrays, of course, which are declared like this:

```
MATRIX: array (0..100, 0..100) of Boolean;
```

Now we can write conventional assignments like MATRIX (1,3) := true;.

The index type (which in MATRIX is integer) and the element type (Booleans in MATRIX) don't have to be the predefined varieties. Thus, if we declare

```
type BEATLE is (John, Paul, George, Ringo);
type INSTRUMENT is (guitar, drums);
```

we could also declare

```
PLAYS: array (BEATLE) of INSTRUMENT;
```

and then assign

```
PLAYS(Ringo) := drums;
```

Arrays may be initialized at the time of their declaration.

```
PLAYS: array (BEATLE) of INSTRUMENT := (guitar, guitar,
                                        guitar, drums);
```

In this example, the value "guitar" is assigned to the first three components (John, Paul, George) of the PLAYS array, and the value "drums" to the last (Ringo). The same thing could be accomplished in an assignment statement:

```
PLAYS := (guitar, guitar, guitar, drums);
```

The index value may be explicitly named in the assignment:

```
PLAYS := (George => guitar,
          Ringo  => drums,
          Paul   => guitar,
          John   => guitar);
```

This example has the same effect as the previous two. Notice that when index values are named they do not have to appear in any particular order. (Also notice the use of the "=>" symbol rather than the assignment operator.) Finally, there is a shorthand form:

```
PLAYS := (Ringo  => drums,
          others => guitar);
```

This kind of explicit list of array components is called an *aggregate*. There are many ways of forming aggregates in Ada.

Another familiar data structure is the *record* which, unlike arrays, must be declared as a separate type.

```
type CLIENT is record
               NAME:     string (1..25);
               AGE:      integer range 1..100;
               BANKRUPT: Boolean;
               end record;

PERSON: CLIENT;
```

Individual components of a record are accessed by the standard dot notation, e.g.

```
PERSON.NAME := "Waldo P. Wigglesworth   ";
```

Record structures appear in several guises. One variation on the plain vanilla record shown above is the constrained record—one in which the initial value of a constraint parameter is left unspecified until later declarations. This allows considerable variety among variables of one data type.

```
type GEOMETRIC_SHAPE (SIDES: integer) is
     record
     PERIMETER: SIDES * LENGTH_UNIT;
     end record;

TRIANGLE: GEOMETRIC_SHAPE (3);
SQUARE:   GEOMETRIC_SHAPE (4);
```

The constraint parameter, SIDES, appears after the type

If you want COLORS that can be RED, BLUE, and YELLOW, why settle for integers that can only be numbers?

name. It is an integer variable, but the initial value depends on the declarations of TRIANGLE and SQUARE, which create GEOMETRIC SHAPES of three and four sides respectively. LENGTH UNIT must have been previously declared and set to some value. If the value had been 5 then TRIANGLE.PERIMETER would equal 15.

Arrays may be similarly constrained and both structures may be mutated in various other ways.

Attributes

Data types and structures in any language have certain attributes. An attribute of the integer data type could be the largest integer available on a particular computer. One attribute of an array structure might be the range of its index type (e.g. John..Ringo in the PLAYS array.)

In pre-Ada languages, after these attributes had been coded or hard-wired they were no longer directly available to the programmer. In Ada they are. Several attribute functions are available to query the various features of types and variables. Attributes are formed by writing an identifier followed by a single quote mark and the name of the attribute. RANGE is an important attribute. Writing PLAYS RANGE is the same as writing "John..Ringo." Thus, we could loop over the range of Beatles by writing

```
for SINGER in PLAYS'RANGE loop
    put (SINGER); put (": ");
    put (PLAYS(SINGER));
    new_line;  -- cr/lf function in TEXT_IO
    end loop;
```

which would produce the following output:

```
John: guitar
Paul: guitar
George: guitar
Ringo: drums
```

The same output would have been produced by writing

```
for SINGER in John..Ringo loop
```

or

```
for SINGER in BEATLE loop
```

either of which would probably have been more elegant. In general, Ada gives you more ways to say the same thing than any other language.

There are 48 pre-defined attributes in Ada. Some of them behave differently depending on the object that they are appended to—FIRST, for example. When stuck onto an array, FIRST yields the lower bound of the index. PLAYS' FIRST equals John. When applied to the integer data type, FIRST gives the lowest available integer. On a 16-bit machine, INTEGER'FIRST would be - 32768.

Some attributes have parameters. Suppose we had declared a three-dimensional array called THREE_D._The attribute THREE_D'FIRST (3) would give the lower boundary of the third index. Enumeration types have several attributes of their own including SUCC and PRED, which yield the successor and predecessor of a particular enumeration value. For example, BEATLE'PRED(Ringo) is George. BEATLE' SUCC(BEATLE'PRED(George)) is George. As I said, it can get baroque.

Our tour of Ada is half over. So far, we have been looking at the small-scale features of the language including basic syntax and the description and manipulation of data. We have seen what Ada programs look like and learned how they exist in the context of a particular environment. Some of the basic data types of Ada made an appearance along with a few more sophisticated constructs such as enumeration types, derived types, aggregates, and attributes.

Now that the small details are taken care of, we can start thinking about the most unusual and innovative aspect of Ada: program organization. This will happen next month. The Countess and I will be looking forward to seeing you again. □

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CIRCLE 187 ON READER SERVICE CARD

Stephen D. Page

The Pascal Directory in Depth, and Pascal Style in Brief

Programmers who write programs which require details of the contents of a disk are fortunate when working with UCSD Pascal. Because the operating system itself was written in Pascal, the disk directory is stored in a record format which is neatly handled as a complex data type.

Unfortunately, neither the Apple release (1.1) nor the Softech release (v. 2) provides details of the directory. This article describes the directory data structure and includes a catalog program which provides examples of various medium-complexity techniques and of what structured programming enthusiasts call "good style."

Listing 1, headed SYMDEF, defines a high-level data structure called "directory," which is an array of directory entries. Entry zero is the volume information. and entries 1-77 correspond to files on the disk. Notice the "stepwise refinement" of the data structure into smaller types, and the use of CONST declarations rather than meaningless integer values.

The data type "direntry," corresponding to an individual entry in the directory, is what Pascal programmers call a "variant record." It can contain two kinds of field lists, depending on the value of the field "filekind." Entry number 0 in the directory has filekind of "untypedfile," to indicate that it is the volume information for the disk: it contains the volume name and length (280 blocks on an Apple), and the date of the last boot using that disk.

The other entries in the directory contain the filename, the number of bytes in the last block of the file, and the date of the last change to the file. All directory entries contain the number of the first block in the file and of the first block after the end of the file.

If we declare a single variable "dir" of type "directory," and use UNITREAD to load the directory information from a disk, we can access any entry by using the format dir[n], where n is the entry number. References to dir[0] will indicate the volume information entry.

Stephen D. Page, 60 Meiers Road, Indooroopilly QLD 4068, Australia.

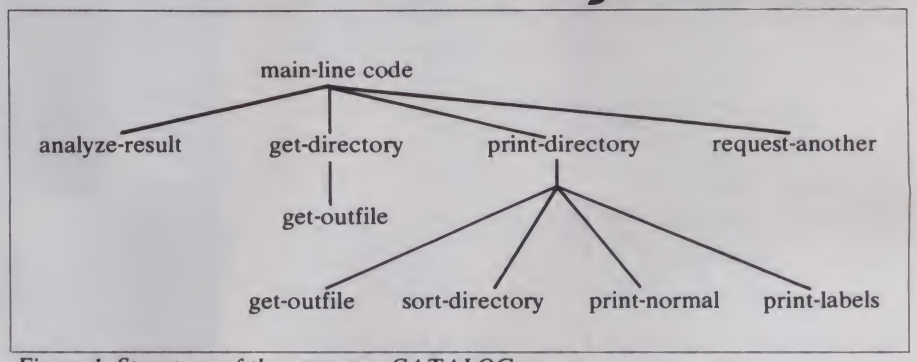

Figure 1. Structure of the program, CATALOG.

Fields within these directory entries may be accessed simply by adding a dot and the field name. Thus dir[3].filename will reference the name of the third file on the disk. Once this concept of record handling is grasped, it is a very simple matter to manipulate all or part of the directory structure.

The Catalog Utility

Listing 2, the program CATALOG, provides examples of manipulating the directory fields and an example of programming style. The program prompts for a disk unit number, then asks for the output destination (defaults to PRINTER:). Two formats are available: a normal printer format and a format for 102 x 36mm labels (easily adaptable for other sizes). The directory is sorted into alphabetical order before listing.

The program may look a bit frightening at first, but it is in clear modules, using a top-down design. To read a structured program it is easiest to start at the highest level, i.e. at the bottom of the listing, where the main-line code lives. This top level is characteristically brief, and contains procedure calls, which refine the process into smaller steps (some of which may be further procedure calls).

Notice that variables, procedures and functions which are only used within one block (i.e. another procedure or function) are declared at the start of that block. The program therefore has the hierarchical structure diagrammed in Figure 1.

There is not enough space to describe program operation in detail. The comments on the listing should be helpful. Notice the use of a file variable "outfile," which can be set with REWRITE to send output to any device, including the console, the printer, or a disk file. Notice also the absence of GOTO and EXIT statements, made possible by the BOOLEAN "finished."

The sort routine is a bit tricky: to avoid having to swap around chunks of memory, it shuffles an array which contains directory entry numbers. When the following routine prints out the file details, it examines the directory entries in the order given in the index array. For details of the insertion sort algorithm itself, see Schneider, Weingart and Perlman, *An Introduction to Programming and Problem Solving With Pascal* (New York: Wiley, 1978), p. 47-48.

Pascal is an extremely powerful language. Using Pascal, a programmer can take a top-down approach, refining the problem in stages. Manipulation of data structures, however complex, is very simple. Time spent developing Pascal skills can be very rewarding. □

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CIRCLE 304 ON READER SERVICE CARD

Listing 1.

```
(*****************************************************************************
 *                                                                           *
 *                                SYMDEF                                     *
 *                                                                           *
 *                                                                           *
 *  Symbol definitions to retrieve information from Apple Pascal directory.  *
 *                                                                           *
 *                        Stephen D. Page, June 1982                         *
 *                                                                           *
 *                                                                           *
 *****************************************************************************)

(* Note: Apple Pascal incorporates UCSD Pascal (trademark of The Regents of the
    University of California). The directory structure of the Apple system is
    based on UCSD specifications.*)

CONST
    (*Definitions of various limits and constants*)
    unitmax = 12;        (*maximum unit number*)
    dirmax = 77;         (*maximum files in directory*)
    dirlocation = 2;     (*directory starts on block 2 of disk*)
    vnamelength = 7;     (*volume name length*)
    fnamelength = 15;    (*file name length*)
    blocksize = 512;     (*blocksize in bytes*)

TYPE
    (*Definition of ranges and miscellaneous types found in directory entries*)
    unitrange = Ø..unitmax;
    dirrange =  Ø..dirmax;       (*range of directory entries - Ø=volume info*)
    byterange = 1..blocksize;    (*range of byte counts up to one block*)

    vname = STRING[vnamelength];
    fname = STRING[fnamelength];

    daterec = PACKED RECORD
        (*usual date format, with the following special features:
            a month of Ø indicates that the date is meaningless,
            and a year of 1ØØ is apparently possible internally
            in the Pascal system.*)
                month: Ø..12;
                day:   Ø..31;
                year:  Ø..1ØØ
            END;

    fkind = (untypedfile,xdskfile,codefile,textfile,infofile,datafile,
                graffile,fotofile,securedir);
        (*note that some of these file types do not normally occur in the
        directories of Apple Pascal v. 1.1, but they must all be declared
        here to ensure correct allocation of enumerated data type.*)

    (*Now for the big one: the directory entry. There are two types of entry:
    the volume information entry at position Ø, and the normal file entries
    at positions 1..dirmax. A case statement determines which we are reading.*)

    direntry = RECORD
                firstblock: INTEGER;            (*first disk block*)
                lastblock:  INTEGER;            (*next disk block*)
                CASE filekind: fkind OF
                    securedir,untypedfile:      (*format of volume info entry*)
                        (volname: vname;        (*disk volume name*)
                        endvol: INTEGER;        (*volume length, i.e. number
                                                   of last block on disk*)
                        numentries: dirrange;   (*number of files in directory*)
                        accesstime: INTEGER;    (*not used in Apple Pascal*)
                        bootdate: daterec);     (*date set at last boot of disk*)
                    xdskfile,codefile,textfile,infofile,datafile,graffile,
                    fotofile:                   (*i.e. all the rest*)
                        (filename: fname;       (*guess what this is!*)
                        endbytes: byterange;    (*number of bytes in last block*)
                        accessdate: daterec);   (*date of last change to file*)
                END; (*CASE and RECORD direntry*)

    directory = ARRAY[dirrange] OF direntry;

(***************************** End of SYMDEF ******************************)
```

Listing 2.

```
PROGRAM catalog;

(*****************************************************************************
 *                                                                           *
 *                                CATALOG                                    *
 *                                                                           *
 *                                                                           *
 *             A program to list an Apple Pascal disk directory              *
 *                                                                           *
 *                        Stephen D. Page, June 1982                         *
 *                                                                           *
 *                                                                           *
 *****************************************************************************)

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(* Load symbol definitions, contained in SYMDEF.TEXT, on the prefix disk *)
(*$I SYMDEF.TEXT*)

VAR
    unit_number: unitrange;
    result: INTEGER;
    dir: directory;
    index: ARRAY[1..dirmax] OF 1..dirmax;
    finished: BOOLEAN;
    outfile: TEXT;

PROCEDURE analyse_result;
(*Global routine to issue an error message for I/O result specified*)
BEGIN
    IF result IN [2,7..9,11,16,64]
        THEN CASE result OF
            2: WRITELN('? Bad device name');
            7: WRITELN('? Illegal file name');
            8: WRITELN('? No room on disk');
            9: WRITELN('? Specified volume is not on line');
           11: WRITELN('? Specified file already exists');
           16: WRITELN('? Disk is write-protected');
           64: WRITELN('? I/O device error (code 64)')
        END
        ELSE WRITELN('I/O error - code = ', result:2)
END;
```

```
PROCEDURE get_directory;
(*This routine prompts the user for a volume number and attempts to
read the directory block of the disk. Errors are trapped and a new
prompt is issued if necessary. An ETX character (returns value of Ø)
or a volume number of Ø will set global boolean "finished".*)
CONST formaterror = 14;  (*I/O error code: invalid input format*)
VAR ok: BOOLEAN;
  PROCEDURE read_directory;
  (*called from get_directory main line, to read the block and
  either set boolean "ok" or issue I/O error message.*)
  BEGIN  (*read_directory code*)
      (*$I-*)  (*turn error checking off to enable our own error trapping*)
      UNITREAD(unit_number,dir,SIZEOF(dir),dirlocation);
             (*read the necessary number of bytes from the proper place*)
      result := IORESULT;  (*save the result, as it can only be read once*)
      IF result > Ø
      (*$I+*)
          THEN analyse_result
          ELSE ok := TRUE
  END;  (*read_directory*)

BEGIN (*get_directory*)
    ok := FALSE;
    REPEAT
        WRITE('Directory of which volume number: ');
        (*$I-*)
        READLN(unit_number);
        result := IORESULT:
        (*$I+*)
        IF result = formaterror  (*returned for input format error*)
            THEN WRITELN('? Volume must be numeric (Ø to exit)')
            ELSE IF result > Ø  (*trap strange errors*)
                 THEN WRITELN('? Error reading volume number, code = ',result:2)
            ELSE IF unit_number = Ø
                 THEN finished := TRUE (*Bomb on ETX character*)
                      ELSE
                        IF NOT (unit_number IN [4,5,9..12])
                          THEN WRITELN('? Unit is not a diskette device')
                          ELSE read_directory; (*this will set "ok" if it worked*)
    UNTIL finished OR ok  (*go back if an error occurred*)
END;

(*-----------------------------------------------------------*)

PROCEDURE print_directory;
(*Routine to produce the directory listing. It prompts for an output file,
sorts the directory information, and outputs a formatted listing for either
labels or normal styling.*)
VAR ch: CHAR; (*used in the mainline print-directory code*)
  FUNCTION get_outfile: BOOLEAN;
  (*Prompts for an output file, which may be null (i.e. a carriage return),
  in which case PRINTER: is supplied, or may be just a period, in which case
  CONSOLE: is supplied. Filenames not ending in '.' and not containing
  '.TEXT' in upper or lower case are supplied with an extension of .TEXT
  automatically. The file is opened, and if all went well TRUE is
  returned. If not, FALSE is returned and error messages are issued.*)
  VAR filespec: STRING;
  BEGIN
      get_outfile := FALSE;
      WRITE('Output file (default = PRINTER): ');
      READLN(filespec);
      IF filespec = '' THEN filespec := 'PRINTER:'
          ELSE IF filespec = '.' THEN filespec := 'CONSOLE:'
          ELSE IF (filespec[LENGTH(filespec)] <> '.') AND
                  (POS('.text',filespec) = POS('.TEXT',filespec))
                  THEN filespec := CONCAT(filespec,'.TEXT');
      (*$I-*)
      REWRITE(outfile, filespec);
      result := IORESULT;
      (*$I+*)
      IF result > Ø THEN analyse_result
          ELSE get_outfile := TRUE
END;

PROCEDURE sort_directory;
(*Routine to sort the directory entries into alphabetical order. An insertion
sort is used, and to save overheads the sort is made on an index of pointers
to entries in the array "dir".*)
VAR small: fname;
    location, temp, pointer, i: 1..dirmax;
BEGIN
    (*First, initialize index to point to entries in the order they were read*)
    FOR pointer := 1 TO dir[Ø].numentries DO index[pointer] := pointer;
    (*Now sort the index, with starting point incremented by one each pass*)
    FOR pointer := 1 TO dir[Ø].numentries - 1 DO
      BEGIN
        small := dir[index[pointer]].filename;
        location := pointer;
        (*examine from starting point to end of index, looking for smallest*)
        FOR i := pointer + 1 TO dir[Ø].numentries DO
            (*compare the filename in the directory entry pointed to by
            the current index entry with the smallest found yet*)
            IF dir[index[i]].filename < small THEN
              BEGIN
                small := dir[index[i]].filename;
                location := i
              END;
        (*Now swap the smallest found in this pass with the starting item*)
        temp := index[pointer];
        index[pointer] := index[location];
        index[location] := temp
      END  (*and loop repeats for rest of directory*)
END;

PROCEDURE print_normal;
(*Routine to print catalog in normal format. Information written to output file
includes: date disk was last booted (not always significant, but the Pascal
system doesn't bother to set month to Ø to indicate this!!), volume name,
file names, file sizes and types, creation dates, and totals (number of free
blocks is calculated to take into account blocks Ø-5, which are reserved
for use by Pascal system.*)
CONST reservedblocks = 6; (*6 blocks (Ø-5) contain disk info and bootstrap*)
VAR i,f, blocks: INTEGER;
PROCEDURE writedate(date: daterec);
  (*This routine writes the date passed as an argument in the format
  dd-mmm-yy. Output goes to the file 'outfile'. *)
  BEGIN
      WRITE(outfile,date.day:2, '-');
      IF (date.month > Ø) AND (date.month < 13)
          THEN CASE date.month OF
                  1: WRITE(outfile,'Jan');    7: WRITE(outfile,'Jul');
                  2: WRITE(outfile,'Feb');    8: WRITE(outfile,'Aug');
                  3: WRITE(outfile,'Mar');    9: WRITE(outfile,'Sep');
                  4: WRITE(outfile,'Apr');   1Ø: WRITE(outfile,'Oct');
                  5: WRITE(outfile,'May');   11: WRITE(outfile,'Nov');
                  6: WRITE(outfile,'Jun');   12: WRITE(outfile,'Dec')
               END
          ELSE WRITE(outfile,'???');
      WRITE(outfile,'-', (date.year MOD 1ØØ):2)
  END;
```

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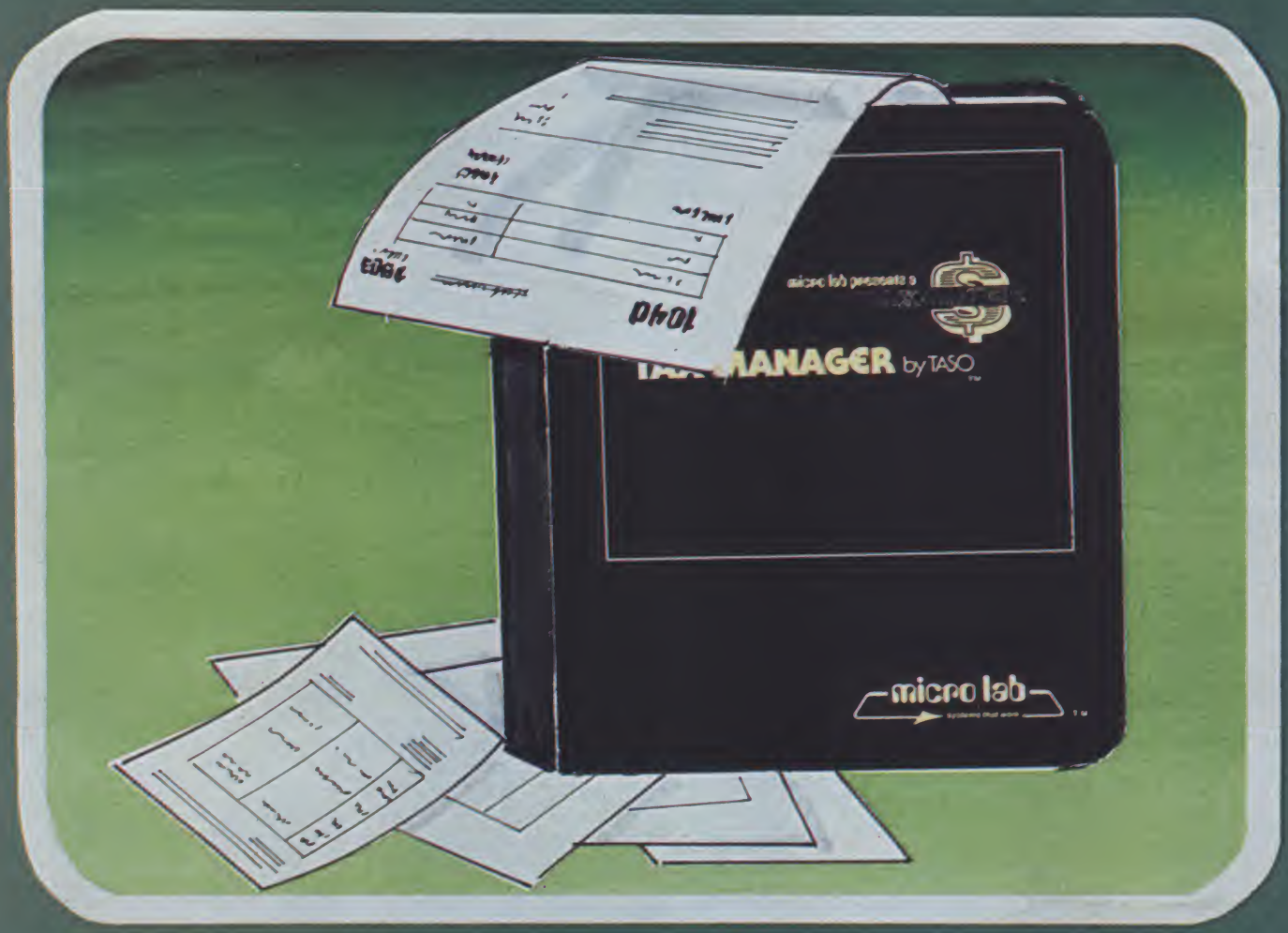

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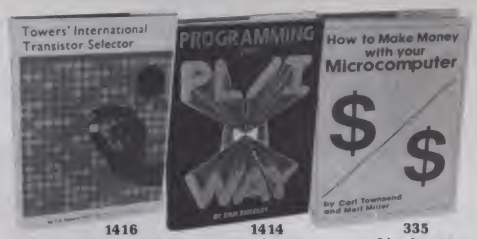

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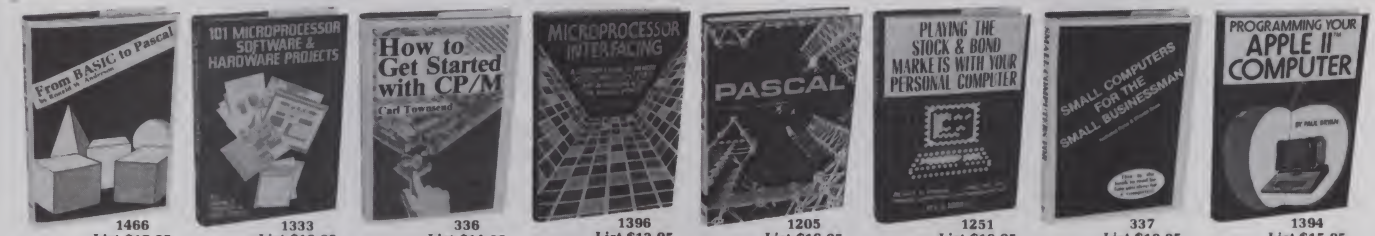

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```
BEGIN
    WRITE(outfile,dir[Ø].volname,':');
    IF dir[Ø].bootdate.month > Ø THEN (*month of Ø indicates meaningless date*)
        BEGIN
            WRITE(outfile,'     last booted on ');
            writedate(dir[Ø].bootdate)
        END;
    WRITELN(outfile); WRITELN(outfile);
    IF dir[Ø].numentries = Ø THEN WRITELN(outfile,'**** EMPTY DISK ****')
      ELSE BEGIN
          sort_directory;
          blocks := reservedblocks; (*allow for the disk info etc.*)
          FOR f := 1 TO dir[Ø].numentries DO WITH dir[index[f]] DO
            BEGIN
              WRITE(outfile,filename);
              FOR i := LENGTH(filename) TO fnamelength + 5
                DO WRITE(outfile,' ');
              CASE filekind OF
                xdskfile: WRITE(outfile,'Xdskfile');
                codefile: WRITE(outfile,'Codefile');
                textfile: WRITE(outfile,'Textfile');
                infofile: WRITE(outfile,'Infofile');
                datafile: WRITE(outfile,'Datafile');
                graffile: WRITE(outfile,'Graffile');
                fotofile: WRITE(outfile,'Fotofile');
                securedir:WRITE(outfile,'????????'); (*Should never occur*)
                untypedfile:WRITE(outfile,'Untyped!')
                END;
              blocks := blocks + lastblock - firstblock;
              WRITE(outfile,'    ',(lastblock-firstblock):3,'    ');
              IF accessdate.month > Ø THEN writedate(accessdate);
              WRITELN(outfile)
            END;
      WRITELN(outfile);
      WRITELN(outfile,'Total of ',dir[Ø].numentries:2,' files, ',
              blocks:4,' blocks    -  ',(dir[Ø].endvol - blocks):4,
              ' free')
  END
END;

PROCEDURE print_labels;
(*Routine to print volume name and file names only, in labels format as
defined by constants at head of routine.*)
CONST label_width = 3;  (*number of filenames across each line*)
      label_height= 8;  (*lines down*)
      label_space = 1;  (*lines between labels*)
      horiz_gap   = 1;  (*spaces between filenames, horizontally*)
VAR i,f,line_number: INTEGER;
BEGIN
    WRITELN(outfile,dir[Ø].volname,':');
    IF dir[Ø].numentries = Ø
      THEN BEGIN
          WRITELN(outfile,'****** EMPTY DISK ******');
          FOR i := 2 TO label_height + label_space DO WRITELN(outfile)
                (*skip to top of next label form*)
        END
      ELSE BEGIN
        sort_directory;
        f := 1; line_number := 1;
        WHILE f <= dir[Ø].numentries DO
          WITH dir[index[f]] DO
            BEGIN
              WRITE(outfile,filename);
              IF f MOD label_width = Ø
                  THEN
              BEGIN
                WRITELN(outfile);
                line_number := line_number + 1;
                IF line_number >= label_height
                 THEN BEGIN
                       FOR i := 1 TO label_space DO WRITELN(outfile);
                       line_number := Ø
                      END;
              END
            ELSE FOR i := LENGTH(filename) TO fnamelength + horiz_gap-1
                 DO WRITE(outfile,' ');
          f := f+1
        END;
      IF f MOD label_width <> Ø THEN WRITELN(outfile);
      IF line_number > Ø
          THEN FOR i := line_number TO label_height + label_space - 1
                DO WRITELN(outfile)
    END
  END;

(*-----------------------------------------------------------*)

BEGIN  (*print_directory main body*)
    IF get_outfile THEN
        BEGIN
            REPEAT
                WRITE('Output in labels format (Y or N)? ');
                READ(ch); WRITELN;
            UNTIL ch IN ['Y','y','N','n'];  (*check lower case as well!*)
            IF ch IN ['Y','y'] THEN print_labels ELSE print_normal;
            CLOSE(outfile, LOCK)
        END
END;

PROCEDURE request_another;
(*Routine to ask user if another listing is required. Sets "finished" if
another is not required.*)
VAR ch: CHAR;
BEGIN
    WRITE('Another directory required (Y or N): ');
    READ(ch);WRITELN;
    IF NOT((ch='Y') OR (ch='y')) THEN finished := TRUE
END;

BEGIN   (*main-line code*)
    finished := FALSE;
    REPEAT
        get_directory;
        IF NOT finished THEN
            BEGIN
                print_directory;
                request_another
            END
    UNTIL finished
END.
```

The Towers Of Hanoi

A Lesson In Recursive Basic

Kimball M. Rudeen

The program described in this article is based on the recursive programming techniques described by Antonio Leal ("Recursive Programming in Basic," *Creative Computing*, Dec. 1981). When I first read the article, I was immediately reminded of a course in Pascal I took some years ago. One feature of this course was a very effective demonstration of recursion as both a programming and a problem-solving method. I decided to see if Dr. Leal's techniques could be applied to the task addressed in the demonstration.

The demonstration involved a problem known as the Towers of Hanoi. For the benefit of the uninitiated, this is as follows: You are given three rods and N disks, of different sizes. The disks can be stacked on any of the rods, forming towers.

Suppose the N disks are stacked in decreasing size on rod A, as shown in Figure 1 for N=4. The task is to move the N disks from rod A to rod C, in such a way that they wind up in the same order on rod C as on rod A. The moves made must meet the following requirements:

1. In each step, only one disk can be moved from one rod to another rod.
2. A disk may never be placed over a smaller disk.
3. Rod B may be used to store disks.

When the moves are made in the optimum manner, the number of moves necessary to move N disks is(2**N)-1;that is, three moves for two disks, seven moves for three disks, 15 moves for four disks, and so on. There is supposedly a legend that in a remote temple there are three rods and a set of 64 disks. The priests of this temple have been moving the disks from rod to rod since the world began. When the task is complete, the world will end. For 64 disks the number of moves is 18,446,744,073,709,551,615. If one move is made per second, this will take about 58 trillion years.

In my Pascal course, we were shown how recursion could be used to solve a problem by redefining it as a set of subproblems which were either trivial or simpler versions of the original problem. For the Towers of Hanoi, the main problem is, "Move N disks from rod A to rod C." This can be broken into three subproblems:

1. Move N-1 disks from rod A to rod B.
2. Move one disk from rod A to rod C.
3. Move N-1 disks from rod B to rod C.

The application of recursion is immediately evident. Each of the more difficult subproblems can be broken down into three still simpler sub-subproblems, and so on, until N-1 is equal to 1 and the final set of subproblems is a simple set of moves of single disks. It is only necessary to write a routine that will break any given disk problem down into the three subproblems and call itself to solve the more difficult ones.

Listing 1 is a Basic program written to use this approach. The recursive subroutine first increments the level count used to maintain the local variables, and sets the disk count for the current level. The next three sections mirror the subproblem breakdown described above.

Section 1 redefines the current problem into the first subproblem for the level. If the subproblem is now simple (number of disks for this level is one), it is solved. Otherwise Section 1 makes a recursive subroutine call with the new subproblem. When a return from this call occurs, the entire solution to the first subproblem will have been printed out.

Figure 1.

```
        *                 *                 *
        *                 *                 *
        *                 *                 *
    *********             *                 *
   ***********            *                 *
  *************           *                 *
 ***************          *                 *

        A                 B                 C
```

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Section 2 simply solves the second subproblem, which is nothing more than a one disk move. Note that the move is defined on the previous level.

Section 3 defines the third subproblem and solves it or calls the subroutine with the subproblem as in Section 1. When a return from this call occurs, the entire solution to the third subproblem and therefore the entire solution to the problem at this level will have been printed out.

After Section 3, the subroutine will decrement the level count and return to the previous level.

Figure 2 is a listing of the solution to the three-disk case. Each move is illustrated with a diagram showing its effect.

Note that while the subroutine has one return and is entered on one line, it calls itself in two places. At some stages of the solution a return from a lower level will be after Section 1, and at other stages the return will be at the end of Section 3. After the final move of a solution is output, the subroutine will be at the very lowest level of recursion, and all of the unreturned subroutine calls will have been made in Section 3. As a result, the final operation of the program will be a cycle of level decrements and returns until the top level is reached and the routine returns to the main program.

Figure 2.

```
                          A          B          C

                          *          *          *
                          *          *          *
INITIAL                  ***         *          *
                        *****        *          *
                       *******       *          *

                          *          *          *
                          *          *          *
MOVE 1 :A TO C            *          *          *
                        *****        *          *
                       *******       *         ***

                          *          *          *
                          *          *          *
MOVE 2 :A TO B            *          *          *
                          *          *          *
                       *******     *****       ***

                          *          *          *
                          *          *          *
MOVE 3 :C TO B            *          *          *
                          *         ***         *
                       *******     *****        *

                          *          *          *
                          *          *          *
MOVE 4 :A TO C            *          *          *
                          *         ***         *
                          *        *****     *******

                          *          *          *
                          *          *          *
MOVE 5 :B TO A            *          *          *
                          *          *          *
                         ***       *****     *******

                          *          *          *
                          *          *          *
MOVE 6 :B TO C            *          *          *
                          *          *       *****
                         ***         *     *******

                          *          *          *
                          *          *          *
MOVE 7 :A TO C            *          *         ***
                          *          *       *****
                          *          *     *******
```

Listing 1.

```
10 REM        TOWERS OF HANOI
20 REM     BY KIMBALL M. RUDEEN
30 CLEAR 1000
40 DEFINT A-Z
50 INPUT "NUMBER OF DISKS";N
60 DIM ND(N),X$(N),Y$(N),Z$(N)
70 X$(1)="A"
80 Y$(1)="C"
90 Z$(1)="B"
100 LV=1
110 ND(1)=N
120 NM=0
130 GOSUB 1000
140 LPRINT "PROBLEM COMPLETE"
150 END
1000 REM RECURSIVE SUBROUTINE
1010     LV=LV+1
1020     ND(LV)=ND(LV-1)-1
1030 REM SECTION 1
1040       X$(LV)=X$(LV-1)
1050       Y$(LV)=Z$(LV-1)
1060       Z$(LV)=Y$(LV-1)
1070       IF ND(LV)=1 THEN NM=NM+1:LPRINT MOVE";NM;":";X$(LV);
           " TO ";Y$(LV)
           ELSE GOSUB 1000
1080 REM SECTION 2
1090       NM=NM+1:LPRINT "MOVE";NM;":";X$(LV-1);" TO ";Y$(LV-1)
1100 REM SECTION 3
1110       X$(LV)=Z$(LV-1)
1120       Y$(LV)=Y$(LV-1)
1130       Z$(LV)=X$(LV-1)
1140       IF ND(LV)=1 THEN NM=NM+1:LPRINT "MOVE";NM;":";X$(LV);
           " TO ";Y$(LV)
           ELSE GOSUB 1000
1150     LV=LV-1
1160     RETURN
```

This program is a very good example of the power of recursive programming, even in a language not specifically designed for it. The structure of the subroutine is extremely simple, even in Basic. In Pascal, which requires no bookkeeping on local variables, the program for this problem seemed to be no more than a subroutine that did nothing but call itself.

One final point of interest is the size of the problem that the program can, in theory, solve. The amount of memory required for the variable arrays depends on the number of disks, not on the number of moves in the final solution. Even the maximum "stack" of recursive subroutine calls that can exist at one time is equal to the number of disks minus one. I find it a little mind-boggling that if handed the 64-disk problem, the program will almost immediately begin printing out the solution, and that given enough time (and paper) it will finish. □

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Programming Data Structures In Basic

Part 3

Edward Mitchell

Part two of this four-part series showed how the memory of a computer can be organized into data structures such as lists, stacks, queues and trees. This month's article shows how to create and use the structures in Basic programs, and presents the source listing of the genealogical database designed in Part Two.

All program examples, except where otherwise noted, are written in Advanced Basic on the IBM Personal Computer. All should run on other computers that use Microsoft Basic, such as the Radio Shack Model II or the Osborne 1.

Allocating Memory

Each data structure requires a changing or "dynamic" area of memory. The stack, for example, needs an ever increasing amount of memory as new numbers are pushed. When the numbers are popped, the memory becomes free.

List elements can appear anywhere in memory because each element is linked to the next by a pointer. It isn't necessary to place elements one right after the other. Furthermore, when elements are deleted, the memory space that was occupied must be made free and available for future use.

Unfortunately, a language like Basic doesn't provide for dynamic allocation of memory. Many Basics allow an array to be dimensioned only once during program execution—DIM A(100) cannot be changed later to DIM A(150), at least not without destroying the older data in array A(). This means that the Basic program must simulate dynamic memory allocation. The section on lists shows one approach to allocating memory dynamically in Basic programs.

Stacks

A simple way to create a stack is to use an array and an index or pointer variable. Let DIM S(100) be space for a stack having up to 100 elements, and let P be a pointer to the top of the stack. Initially set P to 1. To add or push data on to the stack, the program executes,

```
S(P)=D
P=P + 1
```

Edward Mitchell, 813 West Stevens Ave., #1, Santa Ana, CA 92707.

For example, a stack containing five numbers,

```
P=6
    S(5) =21
    S(4) =13
    S(3) =8
    S(2) =5
    S(1) =3
```

A pop is the reverse of the push,

```
P=P - 1
D=S(P)
```

Appropriate checks should insure that P does not exceed the dimensions of S(100).

Queues

A queue can be implemented by using a variation of the stack. With a queue, elements are always removed from the head and added at the tail. Instead of a single stack pointer, the queue needs two pointers: H for head and T for tail.

Let DIM Q(100) be a queue having 100 elements. At first, the queue is empty, so we have,

```
H=1     and     T=0
```

To add a value D to the tail of the queue, set

```
T=T + 1
Q(T)=D
```

Adding to the queue is the same as a push onto the stack. The major difference occurs when an element is removed from the head:

```
D=Q(H)
H=H + 1
```

Adding and deleting elements to the queue is illustrated by Figure 1. Initially there are five elements in the queue. At (b) a new element is added to the tail and at (c) one element is removed from the head. Two problems must be dealt with in this arrangement.

First, what happens when either H or T exceeds 100? One solution is to reset either value to 1 so that the queue "wraps around" back to the first element of Q(). Element 1 then follows element 100 in a circular fashion, as illustrated in Figure 2.

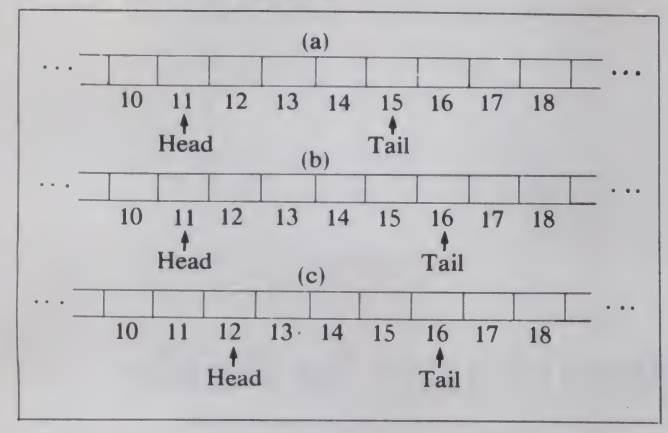


Figure 1. A queue data structure represented in an array.(a) shows a queue with five items. A new element is added to the tail in (b), while another is removed from the head in (c).

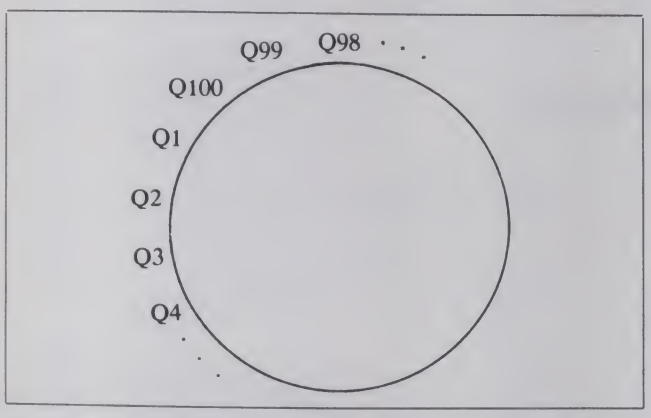


Figure 2. A circular queue is programmed in a fixed size array. If we define DIM Q(100) as an array of 100 numbers, then the queue can be made to grow by having it "wrap around" when reaching Q(100). In effect, Q(100) is followed by Q(1). Listing 2 uses this technique to implement a queue structure.

Second, if the queue has more than 200 entries, the tail will overtake the head and data will be destroyed. To detect when the queue is full, a variable N is used that counts the number of elements in the queue. A complete set of subroutines to add and delete queue entries is shown in Listing 1.

Before adding or deleting elements, the program should GOSUB 1000 to initialize the queue variables. The variable MAX should be set to the maximum size of the queue (for 100 entries MAX=100) and a DIM Q(MAX) should be placed near the start of the program.

The queue can be made to hold more than just numbers by changing the array Q() to some other type. By changing DIM Q(100) to Q$(100), and D to D$, the queue may contain a list of names.

Several arrays can hold additional data in parallel. For example, DIM Q1(100), Q2(100), and Q3(100), and let D1, D2, and D3 be additional data variables. To add the name D$ and the three numeric values, perform

```
T=T + 1
Q$(T) =D$
Q1(T) =D1
Q2(T) =D2
Q3(T) =D3
```

To remove data from the head of the queue, execute the statements,

```
D$=Q(H)
D1=Q1(H)
D2=Q2(H)
D3=Q3(H)
```

See the articles by Gorney for more information about queues.

Lists

As mentioned earlier, list elements do not have to appear one after the other, but may appear in any order. That means a simple array and a couple of pointers will not work. If a list element in the middle of the array is deleted, the program must keep track of the freed space, otherwise unusable holes develop.

For a list of names, three arrays are created. DIM N$(100) holds the name part of each field. DIM P(100) is the pointer to the previous entry in the list, and DIM N(100) is a pointer to the next entry in the list. Let H be a pointer to the head of the list, and let T point to the tail of the list. Like the queue, these two variables point to the first and last elements of the list, respectively. Graphically, a short list of names appears as

The "previous" field for GEORGE (denoted by P) and the "next" field for LISA (denoted by N) don't point anywhere because they are at the head and tail of the list, respectively.

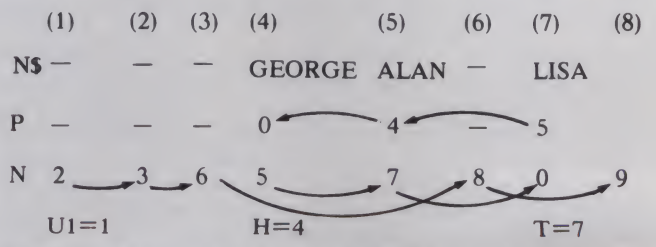
When represented as arrays, the list might appear as:

N$(3)=LISA	N(3)=1	P(3)=7
N$(1)=SAM	N(1)=0	P(1)=3
N$(7)=GEORGE	N(7)=3	P(7)=0

Note that the elements are not consecutive, and that they do not have to begin at the first element in the arrays. P(4) and N(7) are both 0 because they don't point anywhere. By tracing the P() and N() pointers, verify for yourself that the three names are correctly linked together.

In the N$(), P() and N() arrays, each of the elements is either used or unused. The used entries are all linked together by the P() and N() pointers. To keep track of the free entries, the program may link the unused elements together, again using the P() or N() arrays.

For example, let U1 be the index of the first unused entry and let U2 be the tail of the unused list. The list consisting of GEORGE, ALAN, and LISA might be represented as shown below,



In effect, the arrays are holding two lists simultaneously: the list of names and the list of unused entries.

To remove ALAN from the list, the entry at location 5 must be unhooked from the name list and then added to the tail of the unused entries list. The deletion is performed by setting N(4) to point to 7, so that it by-passes location 5. Similarly, P(7) is set to point to location 4. The newly freed entry is then attached to the tail of the unused list, by executing,

```
N(U2)=5
N(5)=0
U2=5
```

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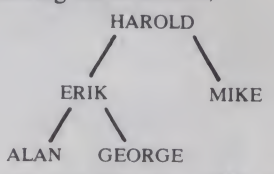
Listing 2 presents sample routines to implement a list structure. To insert names, select option A (for add). When it asks for the location, enter 0 and then the name to add. Thereafter, to add names, enter the location at which the new name should follow.

For example, after entering the first name, the Head and Tail are both set to 1. The second name might then be attached after 1 by entering a 1. Option D displays the list structure, showing both the list of free space and each of the list elements, including the next and previous pointers. The subroutines in Listing 1 can be easily applied to a self-organizing list, like the one described in Parts One and Two.

Trees

Trees are programmed like lists—pointers to the left and right. Subtrees of each node are kept in a set of arrays. Like the list, the names are stored in array N$(). Pointers to the left and right subtrees beneath any node are kept in L() and R(), respectively.

A small tree having the structure,



might be represented in the arrays N$(), L() and R() as

N$(1)=HAROLD	L(1)=2	R(1)=5
N$(2)=ERIK	L(2)=0	R(2)=4
N$(3)=ALAN	L(3)=0	R(3)=0
N$(4)=GEORGE	L(4)=0	R(4)=0
N$(5)=MIKE	L(5)=0	R(5)=0

The zero in the L() and R() values shows that there is no subtree beneath those nodes. You should verify that the values shown above do, indeed, represent the tree structure.

New names are added to the tree by linking in a new branch and leaf at the appropriate node. First, a binary search is used to see if the name to be added already exists. If the name is already in the tree, it cannot be added. When the search completes without having found the name, it has stopped at the point where the name should appear.

For example to add RICHARD to the tree shown above, the algorithm first searches the tree. Seeing that RICHARD is not found to the right of MIKE, the search terminates. Therefore, the name should be placed along a new branch descending to the right of MIKE, giving the tree,

The arrays are updated to show the addition of the new name, giving,

N$(1)= HAROLD	L(1)=2	R(1)=5
N$(2)= ERIK	L(2)=0	R(2)=4
N$(3)= ALAN	L(3)=0	R(3)=0
N$(4)= GEORGE	L(4)=0	R(4)=0
N$(5)= MIKE	L(5)=0	R(5)=6
N$(6)= RICHARD	L(6)=0	R(6)=0

A Basic program, demonstrating searching and adding to a tree structure is shown in Listing 3. Deletion of individual tree entries is not described in this article because there are problems that make deletion a difficult task.

Traversing a Tree

A tree is "traversed" by climbing from node to node or node to leaf within the tree. By changing the direction of the climb, the data in the tree can be read in either ascending or descending order.

To produce an ascending order traversal (also known as "inorder" and "symmetric" order), the traversal algorithm descends as far as it can down the left side of tree. After visiting the leaf on the far left, it moves up to the node immediately above and visits nodes along the right branch. Ascending order traversal algorithms are shown in Algorithms 1 and 2.

Algorithm 1
In Order Tree Traversal

Step Action
1) Set S = Root
2) Traverse Tree (S) (see Algorithm 2)
3) Stop

Algorithm 2
Traverse Tree
Enter with S be the tree to traverse

Step Action
1) If Left Branch (S) exists then
    PUSH S Save S on stack
    S = Left Branch (S)
    Traverse Tree (S)
    S = POP Get old value of S back
2) Display the name at node S
3) If Right Branch (S) exists then
    PUSH S
    S = Right Branch (S)
    Traverse Tree (S)
    S = POP
4) Return

Algorithm 2 is a "recursive" procedure because it calls itself. When programmed in Basic, a stack is used to keep track of the return positions within the tree. To traverse the tree in Figure 3, S is set to 1. Since (1) has a left branch, we place 1 on a stack and descend to (2) by setting S to 2. The stacks looks like

1

Since (2) has a left branch, (2) is placed on the stack and the algorithm descends to (3).

2
1

(3) has no left branch so the algorithm goes to step 3 and prints A. Since there is no right branch it simply moves back up to the previous node by popping (2) from the stack, and returning to step 1 of the original call in Algorithm 2. B is printed, and then at step 4, the algorithm descends the right branch.

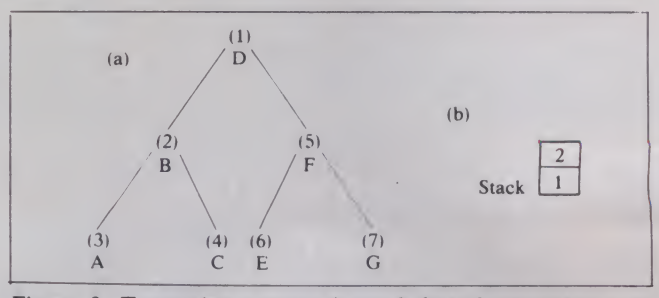


Figure 3. Traversing a tree. A stack based algorithm (see Algorithms 1 and 2) reads the tree from left to right. It descends down the tree as far as it can along left branches. At each mode it places a return point on the stack. At (b) the algorithm has reached node (3) where it prints A. It then pops the return node (2) from the stack and climbs back up the tree to (3) to print B. Then it descends to the right and prints C. Finally it returns to (1) and descends the right branch of node (1).

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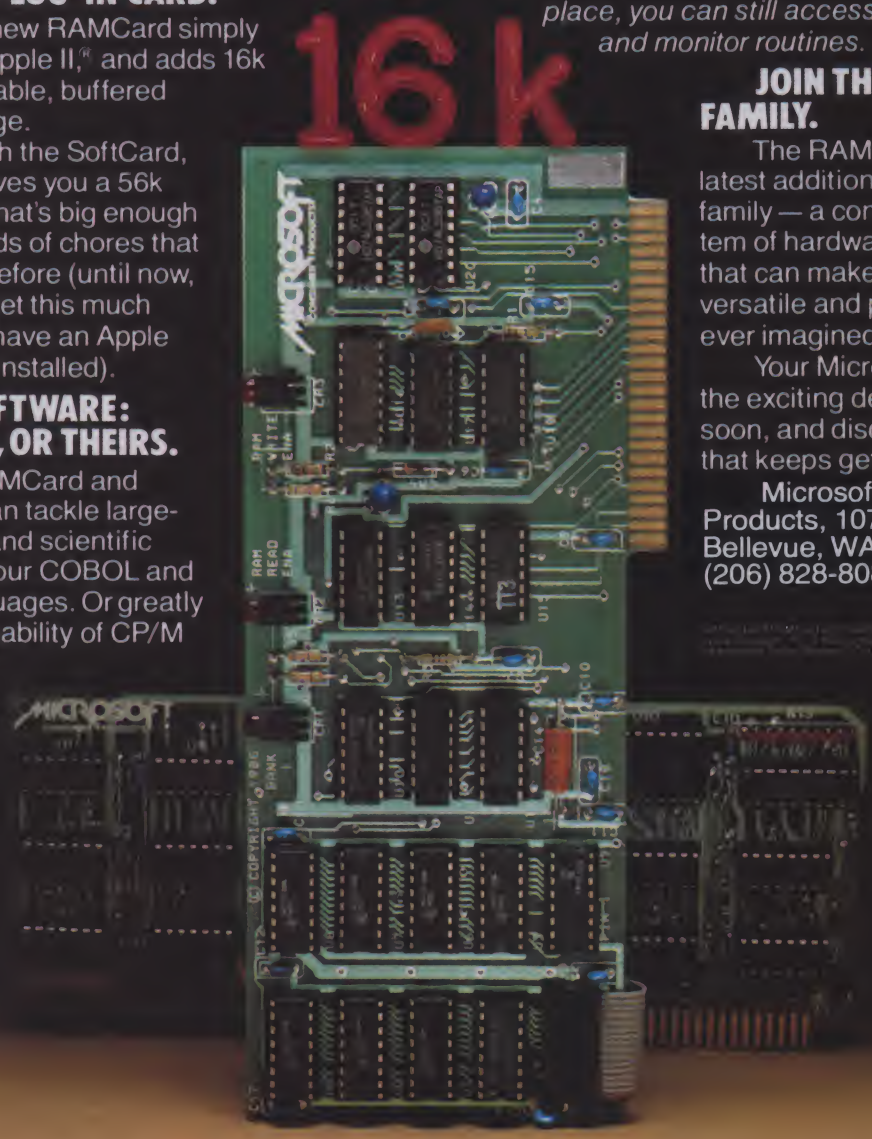

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A Practical Application

Part Two described a genealogical database used for making pedigree charts. The design is based on a tree structured database that provides a natural representation for the problem. The three commands provided by the program are: "Add" to add new ancestors into the database, "Print" to display some or all of the ancestors, and "Change" to modify and update the data file.

The genealogical program is split into several subroutines summarized in Table 1. The major routines Add new ancestor, Print out pedigree chart, and Change data records, provide the user interface, prompting for data, and displaying the results.

Line	Subroutine
100	Select command
1000	Add new ancestor
2000	Print out pedigree chart
3000	Print the name at record R
3500	Print the name and information at record R
4000	Change data records
5000	Perform tree search to find an ancestor
6000	Expand short-hand relationship specification
7000	Open data file
8000	Read record R
9000	Write record R
10000	Update and close file
11000	Exit program

Table 1. Genealogical Program Subroutines.

When a name is added, the program performs a search on the data file looking for the specified relationship. All searches begin at logical record 1. The relationship F means locate the record pointed to by the "father" field of record 1. The notation MF means jump to the mother record, pointed to by the "mother" field and then to the "father" record specified by the "father" field in the "mother's record.

To add a new ancestor, you enter the ancestor's relationship to you. Your grandfather is your father's father, or FF for this program. The search routine sees if that ancestor is already in the tree. If not, a new record is created, and the "father" field of the your father's record is set to point to the new record.

Changing records is fairly easy. After entering the relationship, the search routine locates the correct record. The data is displayed, and you may make changes as necessary. When complete, the updated record is written back to disk.

The Print routine uses some interesting data structure techniques. Any individual in the tree may be displayed. Or, pedigree charts for any individual may be printed. A pedigree chart for the person at the root of the tree includes all of his ancestors.

Entering FMF prints the record corresponding to your great-grandfather. If you wish to see a pedigree chart for your great-grandfather, enter FMF+, meaning display FMF *plus* all of his ancestors. The same notation can limit the size of the pedigree chart. FMF+1 means display FMF plus one more generation, which is his parents. FMF+2 displays both his parents and his grandparents.

The program shown in Listing 4 is limited to 16 generations because of the use of integers for the father and mother pointer fields. Additionally, each record requires 128 bytes of storage, which means only about 780 ancestors can be entered per 100K of disk storage. For many people that is not a severe limit, but for others it may be very constraining.

One alternative is to keep just the names on the disk file, with perhaps an index number identifying an external record of the ancestor. That would expand the storage capability to over 3000 names per 100K of disk storage. Also, when extending the pedigree chart back many generations, it might be best simply to create a separate database starting at, say, the eighth generation.

Summary

The lack of dynamic memory allocation in Basic requires that data structures be set up within fixed size arrays. Stacks and queues are easily programmed by using an array and one or more pointer variables.

On the other hand, lists and trees both require several arrays and complex programming to link all the elements together. But without data structure techniques, the genealogical database would be difficult to build and probably quite slow to operate.

Next month, several sorting techniques, including Shellsort and Quicksort, will be discussed. Quicksort is an especially fast sort algorithm, well suited to sorting large tables of randomly distributed records.

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Standish, Thomas A., *Data Structure Techniques*, Addison-Wesley Publishing Co, Reading, MA 1980.

Swanson, Paul, "PDQ: A Data Manager for Beginners, Don't Reinvent the Wheel," *Byte*, Vol. 6, No. 11, Nov. 1981, p. 236. □

Listing 1. Subroutines to add to and remove elements from a queue. To add a new element, set D$ to the value to be added and execute a GOSUB 2000. To remove a value, execute a GOSUB 3000. D$ will be set to the removed element.

```
1000 REM - INITIALIZE QUEUE
1010 H = 1: T = 0: N = 0
1020 RETURN
2000 REM - ADD ELEMENT TO THE QUEUE
2010 IF N = MAX THEN F = 1: RETURN ELSE F=0
2020 N = N + 1
2030 T = T + 1
2040 IF T > MAX THEN T = 0
2050 Q$(T) = D$
2060 RETURN
3000 REM - REMOVE ELEMENT FROM THE QUEUE
3010 IF N = 0 THEN F = 2: RETURN ELSE F=0
3020 D$ = Q$(H)
3030 N = N - 1
3040 H = H + 1
3050 IF H > MAX THEN H = 1
3060 RETURN
```

Listing 2. Several routines to create and manipulate list structures in Basic.

```
10 MAX=100
20 DIM N$(MAX), N(MAX), P(MAX)
30 GOSUB 1000
40 PRINT "ENTER A(DD R(EMOVE D(ISPLAY Q(UIT ? ";
50 C$=INPUT$(1): PRINT C$
60 ON INSTR(1,"ARDQ",C$)+1 GOSUB 40,80,130,170,32767
70 GOTO 40
80 INPUT "ENTER LOCATION ? ",G
90 INPUT "ENTER NAME ? ",S$
100 GOSUB 2000
110 IF F>0 THEN PRINT "ERROR ",F
120 RETURN
130 INPUT "REMOVE WHAT LOCATION ? ",G
140 GOSUB 3000
150 IF F>0 THEN PRINT "ERROR ",F
160 RETURN
170 GOSUB 4000
180 PRINT "TRACE OF LIST CONTROL INFORMATION"
190 PRINT "FREE SPACE LIST -"
200 P=U1
210 IF P=0 THEN GOTO 230
220 PRINT P,: P=N(P): GOTO 210
230 PRINT : PRINT "USED SPACE LIST-"
240 PRINT "HEAD=";H,"TAIL=";T
250 P=H
```

Listing 2, continued...

```
260 IF P=0 THEN RETURN
270 PRINT "ELEMENT ";P
280 PRINT "NAME=",N$(P),"PREVIOUS=";P(P),"NEXT=";N(P)
290 P=N(P)
300 GOTO 260
1000 REM - INITIALIZE QUEUE
1009 REM - SET UP LIST OF UNUSED SPACE
1010 FOR I = 1 TO MAX
1020 N(I)=I+1
1030 NEXT I
1040 N(MAX)=0
1049 REM - INITIAL UNUSED SPACE LIST HEAD AND TAIL POINTERS
1050 U1=1: U2=MAX
1060 RETURN
2000 REM - ADD ELEMENT TO THE LIST AT POSITION G
2010 IF N=MAX THEN F=1: RETURN ELSE F=0
2029 REM - GET A FREE LOCATION FROM THE UNUSED SPACE LIST
2030 L=U1
2040 IF U1 = U2 THEN U1 = 0: U2 = 0  ELSE  U1 = N (U1)
2050 N$(L)=S$
2059 REM - ADJUST THE PREVIOUS POINTER OF ADJACENT ELEMENT
2060 IF G>0 THEN IF N(G) > 0 THEN P(N(G))=L
2069 REM - SET UP L'S NEXT AND PREVIOUS POINTERS
2070 IF G>0 THEN N(L)=N(G) ELSE N(L)=0
2080 IF G>0 THEN N(G)=L
2084 REM - SPECIAL CASE: INSERTING BEFORE THE HEAD OF A LIST
2085 IF G=0 AND N>0 THEN P(H)=L: N(L)=H
2090 IF G=0 THEN P(L)=0 ELSE P(L)=G
2095 N=N+1
2099 REM - IF THE INSERT AFFECTS THE HEAD OR TAIL, THEN UPDATE H OR T
2100 IF N=1 OR G=T THEN T=L
2120 IF G=0 THEN H=L
2130 RETURN
3000 REM = REMOVE ELEMENT AT LOCATION G
3010 IF N = 0 THEN F = 2: RETURN ELSE F = 0
3019 REM - UPDATE THE HEAD OR TAIL POINTERS IF DELETING THE HEAD OR TAIL
3020 IF H=G THEN H=N(G)
3030 IF T=G THEN T=P(G)
3040 N = N - 1
3049 REM - UPDATE THE NEXT AND PREVIOUS POINTERS OF ADJACENT ELEMENTS
3050 IF N(G) > 0 THEN P(N(G)) = P(G)
3060 IF P(G) > 0 THEN N(P(G)) = N(G)
3069 REM - PLACE THE DELETED ELEMENT ON THE FREE SPACE LIST
3070 IF U2=0 THEN U1=G: U2=G ELSE N(U2) = G
3080 P(G)=0
3090 U2=G
3100 N(U2)=0
3120 RETURN
4000 REM - DISPLAY LIST
4010 P = H
4020 IF P = 0 THEN PRINT: RETURN
4030 PRINT N$(P),
4040 P = N (P)
4050 GOTO 4020
4060 RETURN
32767 END
```

Listing 3. Routines to add names to a tree structure, and to search and display the tree are shown.

```
10 MAX=100
20 DIM N$(MAX), L(MAX), R(MAX), S(20): REM -S() IS STACK NEEDED TO DISPLAY TREE
30 GOSUB 1000
40 PRINT "ENTER A(DD S(EARCH D(ISPLAY L(IST Q(UIT ? ";
50 C$=INPUT$(1): PRINT C$
60 ON INSTR(1,"ASDLQ",C$)+1 GOSUB 40,80,130,120,170,32767
70 GOTO 40
80 INPUT "ENTER NAME ? ",S$
90 GOSUB 3000
100 IF F>0 THEN PRINT "ERROR ",F
110 RETURN
120 GOSUB 4000:RETURN
130 INPUT "SEARCH FOR WHAT NAME ? ",S$
140 GOSUB 2000
150 IF F=0 THEN PRINT S$;" IS IN THE LIST AT ";G ELSE PRINT "ERROR ";F
160 RETURN
170 PRINT "ROOT = ";R
180 FOR I=1 TO N
190 PRINT I;N$(I), "LEFT=",L(I),"RIGHT=",R(I)
200 NEXT I
210 RETURN
1000 REM - INITIALIZE TREE
1010 R=0: REM - SET ROOT OF TREE TO NIL
1020 RETURN
1030 RETURN
2000 REM - SEARCH THE TREE FOR NAME S$
2010 G = R: G1 = R
2020 IF G = 0 THEN F=1: G=G1: RETURN
2030 IF S$ = N$(G) THEN F=0: RETURN
2040 G1=G
2050 IF S$ < N$(G) THEN G = L(G) ELSE G = R(G)
2060 GOTO 2020
3000 REM - ADD A NAME S$ TO THE TREE
3010 IF N= MAX THEN F=4: RETURN
3020 GOSUB 2000: REM - SEE IF THE NAME IS ALREADY IN THE TREE
3030 IF F=0 THEN F=2: RETURN ELSE F=0
3040 N = N + 1
3050 IF G=0 THEN R=N ELSE IF S$ > N$(G) THEN R(G)=N ELSE L(G)=N
3060 N$(N) = S$
3070 RETURN
4000 REM - DISPLAY THE ENTRIES IN THE TREE
4010 G=R: P=0: REM - P IS THE STACK POINTER
4020 IF L(G) <>0 THEN S(P)=G: P=P+1: G=L(G): GOSUB 4020: P=P-1: G=S(P)
4030 PRINT N$(G)
4040 IF R(G)<>0 THEN S(P)=G: P=P+1: G=R(G): GOSUB 4020: P=P-1: G=S(P)
4050 RETURN
32767 END
```

Listing 4.

```
1 ' Pedigree Chart Utility program
2 ' Edw. Mitchell, 16 Feb 1982
3 '
4 '
5 '
10 DIM S%(20)            ' Stack needed when traversing the tree
20 GOSUB 7010            ' open up data file
100 PRINT "Geneological Pedigree Chart Maker"
110 PRINT
120 PRINT "Enter:  A(dd  P(rint  C(hange  Q(uit ? ";
130 C$=INPUT$(1): PRINT C$
140 ON INSTR("APCQ",C$)+1 GOSUB 160, 1010, 2010, 4010, 11010
150 GOTO 110
160 RETURN
1000 '-----------------------------------------
1010 PRINT
1020 IF N%=0 THEN PRINT "Enter your name -" ELSE PRINT "Add New Ancestor"
1030 PRINT
1040 IF N%>0 THEN INPUT "Specify relationship (CR=Exit)? ", R$ ELSE R$="FO"
1050 IF R$="" THEN RETURN
1060 GOSUB 6010
1070 GOSUB 5010
1075 IF N%>0 AND G%<>0 THEN PRINT "That ancestor already exists": GOTO 1030
1080 IF E% THEN IF E%<>LEN(R$) THEN PRINT "That generation is too distant": GOTO
 1040
1090 N%=N%+1             ' Increment total # of entries
1100 PRINT "Enter name ? ";: LINE INPUT ANCESTORNAME$
1120 INPUT "Enter birth date ? ", BDATE$
1130 PRINT "Enter Place of Birth ? ";: LINE INPUT BPLACE$
```

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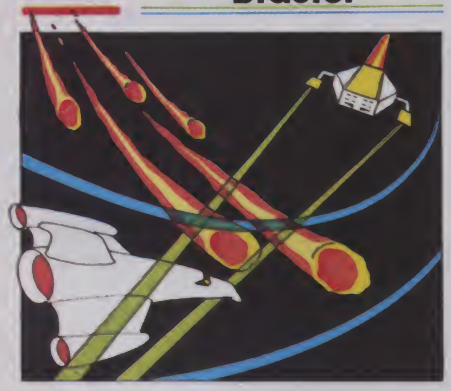

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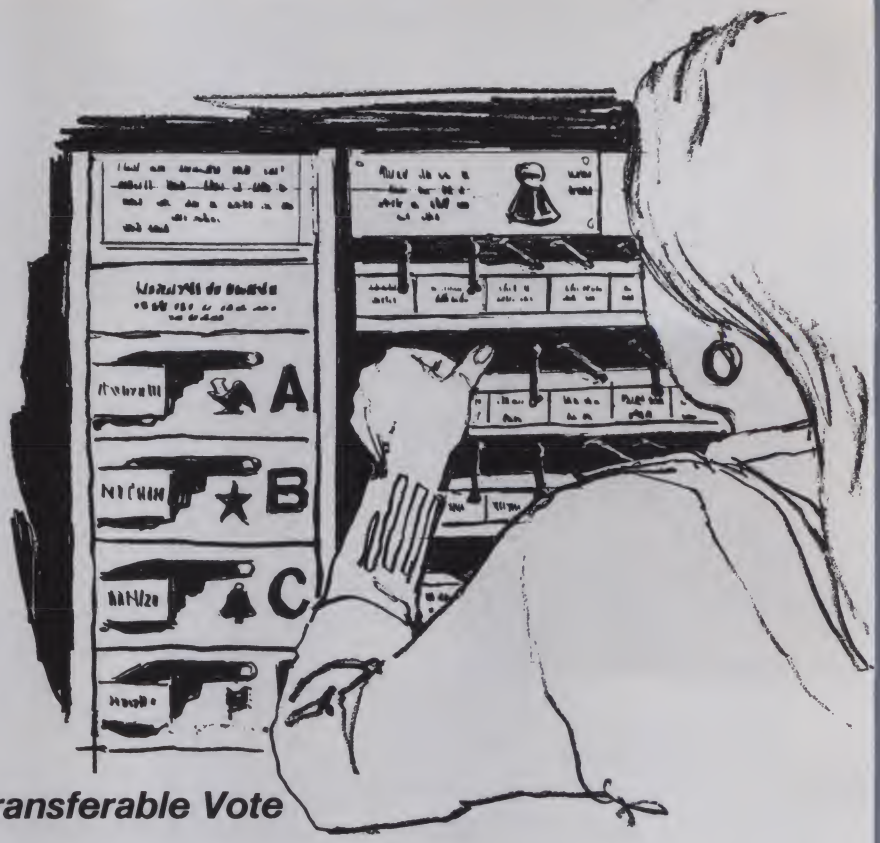
Listing 4, continued...

```
1140 INPUT "Enter Death Date ? ", DDATE$
1150 PRINT "Enter Place of Death ? ";: LINE INPUT DPLACE$
1160 IF L%=0 THEN L%=1  ' Special case of entering first name
1170 R%=L%: GOSUB 8030  ' Read the record
1180 IF RIGHT$(R$,1)="M" THEN MOTHER%=N% ELSE FATHER%=N%
1190 GOSUB 9020         ' Write out descendant's record
1200 FATHER%=0: MOTHER%=0 ' Build record for this ancestor
1210 LSET BIRTHDATE$=BDATE$
1220 LSET BIRTHPLACE$=BPLACE$
1230 LSET DEATHDATE$=DDATE$
1240 LSET DEATHPLACE$=DPLACE$
1250 LSET ANCESTOR$=ANCESTORNAME$
1260 R%=N%              ' Write out the new record
1270 GOSUB 9020
1280 GOTO 1030
2000 '-----------------------------------
2010 PRINT
2020 PRINT "Print Pedigree Chart"
2030 PRINT
2040 INPUT "Enter relationship (+ for all, CR=Exit) ? ",R$
2050 IF R$="" THEN RETURN
2055 IF LEFT$(R$,1)="P" THEN R$=MID$(R$,2): PRINTER%=1: LPRINT CHR$(15): LPRINT
       ELSE PRINTER%=0
2060 I%=INSTR(R$,"+")   ' Check for depth specification
2070 IF I%=0 THEN ALL%=0: GOTO 2110 ELSE ALL%=1
2080 DEPTH%=VAL(MID$(R$,I%+1))
2090 R$=LEFT$(R$,I%-1)
2100 IF DEPTH%=0 THEN DEPTH%=16
2110 GOSUB 6010: GOSUB 5010
2115 IF ALL%=0 THEN R%=L%: GOSUB 3500: GOTO 2030
2120 IF E% OR G%=0 THEN PRINT "Relationship not found": GOTO 2030
2125 GOSUB 2130: GOTO 2030
2130 R%=G%
2140 P%=0               ' Set Stack pointer to 0
2150 GOSUB 8030         ' Read the record
2160 IF P% < DEPTH% THEN IF FATHER% <> 0 THEN S%(P%)=R%: P%=P%+1: R%=FATHER%: GO
       SUB 2150: P%=P%-1: R%=S%(P%)
2170 GOSUB 3010
2180 IF P%<DEPTH% THEN IF MOTHER%<>0 THEN S%(P%)=R%: P%=P%+1: R%=MOTHER%: GOSUB
       2150: P%=P%-1: R%=S%(P%)
2190 RETURN
3000 '-----------------------------------
3010 'Print Entry At Record R%
3020 GOSUB 8030
3030 PRINT TAB(P%*5);ANCESTOR$
3035 IF PRINTER% THEN LPRINT TAB(P%*5);ANCESTOR$: LPRINT
3060 PRINT
3070 RETURN
3500 '-----------------------------------
3510 ' Print all of record R%
3520 GOSUB 8030
3525 PRINT
3530 PRINT ANCESTOR$
3540 PRINT "Born:  "; BIRTHDATE$; TAB(20); "Place:  "; BIRTHPLACE$
3550 PRINT "Died:  "; DEATHDATE$; TAB(20); "Place:  "; DEATHPLACE$
3560 IF PRINTER%=0 THEN RETURN
3565 LPRINT ANCESTOR$
3570 LPRINT "Born:  "; BIRTHDATE$; TAB(20); "Place:  "; BIRTHPLACE$
3580 LPRINT "Died:  "; DEATHDATE$; TAB(20); "Place:  "; DEATHPLACE$
3590 LPRINT
3600 RETURN
4000 '-----------------------------------
4010 PRINT
4020 PRINT "Update Data"
4030 PRINT
4040 INPUT "Enter relationship to update (CR=Exit) ? ", R$
4050 IF R$="" THEN RETURN
4060 GOSUB 6010
4070 GOSUB 5010
4080 IF E% OR N%=0 THEN PRINT "That ancestor does not exist": GOTO 4040
4090 R%=L%
4100 GOSUB 3500
4110 PRINT
4120 PRINT "Enter new name (CR if no change)? "; : LINE INPUT ANCESTORNAME$
4130 INPUT "Enter new birth date ? ", BDATE$
4140 PRINT "Enter new place of birth ? ";: LINE INPUT BPLACE$
4150 INPUT "Enter new death date ? ",DDATE$
4160 PRINT "Enter new place of death ? ";: LINE INPUT DPLACE$
4170 IF ANCESTORNAME$<>"" THEN LSET ANCESTOR$=ANCESTORNAME$
4180 IF BDATE$<>"" THEN LSET BIRTHDATE$=BDATE$
4190 IF BPLACE$<>"" THEN LSET BIRTHPLACE$=BPLACE$
4200 IF DDATE$<>"" THEN LSET DEATHDATE$=DDATE$
4210 IF DPLACE$<>"" THEN LSET DEATHPLACE$=DPLACE$
4220 GOSUB 9020
4230 GOTO 4030
5000 '-----------------------------------
5010 'Lookup ancestor specified by R$
5011 'Return L% as location of descendant if not found
5012 'else, G% is the ancestor.  E% is an error code.
5020 G%=1: L%=0: I%=1: E%=0
5030 IF R$="" THEN L%=1: RETURN
5040 L%=G%: R%=G%: GOSUB 8030
5050 IF MID$(R$,I%,1)="M" THEN G%=MOTHER% ELSE G%=FATHER%
5060 IF G%=0 THEN IF I%<=LEN(R$) THEN E%=I%: RETURN ELSE E%=0: RETURN
5070 I%=I%+1
5080 IF I%>LEN(R$) THEN E%=0: L%=G%: RETURN
5090 GOTO 5040
6000 '-----------------------------------
6010 'Expand short hand relationship notation into standard notation
6020 I%=2
6030 IF I%>LEN(R$) THEN RETURN
6040 IF INSTR("0123456789",MID$(R$,I%,1))=0 THEN I%=I%+1: GOTO 6030
6050 D%=ASC(MID$(R$,I%,1))-48
6060 D$=MID$(R$,I%-1,1)
6070 R$=LEFT$(R$,I%-2)+STRING$(D%,ASC(D$))+MID$(R$,I%+1,LEN(R$)-I%)
6080 I%=I%+D%
6090 GOTO 6030
7000 '-----------------------------------
7010 ' Open Data File
7020 E%=0
7030 ON ERROR GOTO 7120 ' See if the file already exists
7040 OPEN "I",#1,"ANCESTRY"
7050 CLOSE 1
7060 ON ERROR GOTO 0
7070 OPEN "R",#1, "ANCESTRY", 128
7080 FIELD #1, 2 AS FATHER$, 2 AS MOTHER$, 12 AS BIRTHDATE$, 12 AS DEATHDATE$,
       29 AS BIRTHPLACE$, 29 AS DEATHPLACE$, 32 AS ANCESTOR$
7090 FIELD #1, 2 AS NUMENTRIES$
7100 IF E% THEN N%=0 ELSE GET #1, 1: N%=CVI(NUMENTRIES$)
7110 RETURN
7120 E%=1               ' File didn't exist - so create it
7130 RESUME 7060
8000 '-----------------------------------
8010 ' Read Record R%
8020 'READ RECORD R%
8030 GET #1, R%+1
8040 FATHER%=CVI(FATHER$)
8050 MOTHER%=CVI(MOTHER$)
8060 RETURN
9000 '-----------------------------------
9010 ' Write Record R%
9020 LSET FATHER$=MKI$(FATHER%)
9030 LSET MOTHER$=MKI$(MOTHER%)
9040 PUT #1, R%+1
9050 RETURN
10000 '-----------------------------------
10010 ' Update and Close File
10020 LSET NUMENTRIES$=MKI$(N%)
10030 PUT #1, 1
10040 CLOSE 1
10050 RETURN
11000 '-----------------------------------
11010 GOSUB 10020       ' Close File
11020 END
```



Making Every Vote Count

A Program to Tally the Single Transferable Vote

Jim Parr

Democracy is a wonderful thing, but it is not always easy to know how to achieve it. The usual ways of voting sometimes lead to results that just don't seem right. Too many good candidates on one side of an issue can split the vote for that side and throw the election to the other side, even if that other side is favored by the minority. When a committee or council is elected, it is possible for a bare majority, or even just a plurality, to win all the seats, leaving a substantial part of the population without any of their candidates elected. If your favorite doesn't seem to be one of the leading candidates, you may feel compelled to vote for someone you don't like nearly as well.

All of these inequities involve situations in which for some reason, someone's vote doesn't count, or is in danger of being "wasted." That is not just tough luck, or a necessary part of politics; it is a result of the election system.

There is no way for everyone to win, but there is a system that guarantees that everyone's vote will have an effect. It is described here with a program to help do the tallying it requires. If it sounds attractive to you, you may want to propose it in some organization to which you belong.

The System

Of the many methods devised to try to make elections fairer, the most elegant is that of the Single Transferable Vote (STV). We often use the idea of a transferable vote in electing a committee during a meeting: we take a vote among the candidates, eliminate the one with the fewest votes, and vote again.

Once your favorite candidate is eliminated, you get to transfer your vote to your next choice. Besides that kind of transfer, STV also allows transfer of surplus votes of a winning candidate, thus reducing the chance of the majority being underrepresented if they all vote for the same candidate.

Under STV, each voter ranks the candidates in order of preference. A series of tabulations or tallies follows, similar to the series of votes taken in the example of the meeting; except that they are all done from the ballots, so that the voters don't have to be present when the counting is done.

If there are no more surplus points to redistribute, then we eliminate the trailing candidate, the one with the fewest points currently assigned. If my ballot has some points assigned to the trailing candidate, who is my Nth choice, then those points are transferred to my (N + 1)st choice. Surpluses are reassigned first because they may affect who is eliminated. Ties between trailing candidates are decided at random.

This process continues—if there is a surplus, redistribute it; if not, eliminate the trailing candidate—until all the positions are filled.

Results

From your standpoint as voter, the effect is that your entire vote counts. Any part of your vote that your candidate can't use is transferred to your next choice. Voting for a "dark horse" doesn't waste your vote; if he loses, your vote goes to your next choice. Even if all your favorites eventually lose, your vote is in there to the last, if only to express your preference between the two candidates you liked least. Failing to rank all the candidates is the only way that part of your vote could end up not counting.

From the standpoint of the election as a whole, voting blocs (such as parties) will win seats approximately in proportion to their voting strength. Thus STV is one of the methods of achieving "proportional representation." This is in contrast to the usual at-large plurality rules in which a bloc of 49% can be denied representation.

In an election for a single office, "in proportion to their voting strength" means that a candidate cannot win until he has accumulated a majority of the points in the election, including points transferred from losers. A candidate supported only by a minority cannot win the office.

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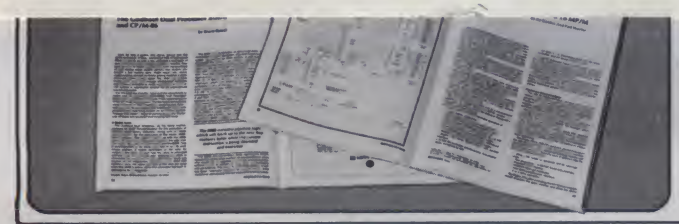

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Figure 1.

```
SAMPLE ELECTION
Here are the five ballots,

Rank recorded beside name:
ARNOLD_2_    ARNOLD_3_    ARNOLD_1_    ARNOLD_4_    ARNOLD_4_
BAKER__1_    BAKER__1_    BAKER__2_    BAKER__5_    BAKER__5_
MEYER__4_    MEYER__4_    MEYER__4_    MEYER__1_    MEYER__2_
MORENO_5_    MORENO_5_    MORENO_5_    MORENO_2_    MORENO_1_
PARK___3_    PARK___2_    PARK___3_    PARK___3_    PARK___3_

Names in preference order:
BAKER        BAKER        ARNOLD       MEYER        MORENO
ARNOLD       PARK         BAKER        MORENO       MEYER
PARK         ARNOLD       PARK         PARK         PARK
MEYER        MEYER        MEYER        ARNOLD       ARNOLD
MORENO       MORENO       MORENO       BAKER        BAKER

Candidate numbers
assigned at random:          11000 DATA 3,5
ARNOLD    5                  11010 DATA 1, 5, 2, 4, 3, 0
BAKER     1                  11020 DATA 1, 2, 5, 4, 3, 0
MEYER     4                  11030 DATA 5, 1, 2, 4, 3, 0
MORENO    3                  11040 DATA 4, 3, 2, 5, 1, 0
PARK      2                  11050 DATA 3, 4, 2, 5, 1, 0
                             11060 DATA -1
```

(In a single-office election there is a method which is sometimes better than STV. A compromise candidate might be best, but might be everyone's second choice and be eliminated by STV as the trailing candidate on an early tally. To avoid that, for each pair of candidates A and B, count how many voters prefer A to B and vice-versa. If there is a candidate who wins all his one-on-one comparisons, that is the winner. If there is no such winner, use STV.)

I first encountered STV in the council elections for the department in which I work. People who do not want to serve cross their names off a list of those eligible, and the department votes by STV on those remaining. Rotation of membership is guaranteed by our rule that a person cannot serve two consecutive terms. The department has two major groups which get along well together, and even overlap, but have different interests. Our elections assure appropriate representation to each, without any need to designate them formally, or for some nominating committee to try to achieve a "balance." The balance is provided by the voters, through STV.

Figure 2.

```
QUOTA = 1260; 2 WINNERS: 1 5
HIGH = 1; LOWS = 3 4
TOTAL SURPLUS = 276; DIFFERENCE = 204
DISTRIBUTE EXCESS OF CANDIDATE 1

TALLY NUMBER 5

     1:    517     0     0   102   381
     2:    517     0     0   102   381
     3:    226     0     0    50   724
     4:      0     0     0  1000     0
     5:      0     0  1000     0     0
    SUM   1260     0  1000  1254  1486
    CAND     1     2     3     4     5
QUOTA = 1260; 2 WINNERS: 1 5
HIGH = 5; LOWS = 3 4
TOTAL SURPLUS = 226; DIFFERENCE = 254
ELIMINATE CANDIDATE 3

TALLY NUMBER 6

     1:    517     0     0   102   381
     2:    517     0     0   102   381
     3:    226     0     0    50   724
     4:      0     0     0  1000     0
     5:      0     0     0  1000     0
    SUM   1260     0     0  2254  1486
    CAND     1     2     3     4     5
QUOTA = 1260; 3 WINNERS: 1 4 5

  Program output:

  DISPLAY DETAILED TALLIES (Y/N)?Y
  BALLOTS
  1 :  1  5  2  4  3
  2 :  1  2  5  4  3
  3 :  5  1  2  4  3
  4 :  4  3  2  5  1
  5 :  3  4  2  5  1

TALLY NUMBER 1

     1:   1000     0     0     0     0
     2:   1000     0     0     0     0
     3:      0     0     0     0  1000
     4:      0     0     0  1000     0
     5:      0     0  1000     0     0
    SUM   2000     0  1000  1000  1000
    CAND     1     2     3     4     5
QUOTA = 1260; 1 WINNERS: 1
HIGH = 1; LOWS = 2 3
TOTAL SURPLUS = 740; DIFFERENCE = 1000
ELIMINATE CANDIDATE 2
HIGH = 1; LOWS = 3 4
TOTAL SURPLUS = 740; DIFFERENCE = 0
DISTRIBUTE EXCESS OF CANDIDATE 1

TALLY NUMBER 3

     1:    630     0     0     0   370
     2:    630     0     0     0   370
     3:      0     0     0     0  1000
     4:      0     0     0  1000     0
     5:      0     0  1000     0     0
    SUM   1260     0  1000  1000  1740
    CAND     1     2     3     4     5
QUOTA = 1260; 2 WINNERS: 1 5
HIGH = 5; LOWS = 3 4
TOTAL SURPLUS = 480; DIFFERENCE = 0
DISTRIBUTE EXCESS OF CANDIDATE 5

TALLY NUMBER 4

     1:    630     0     0   102   268
     2:    630     0     0   102   268
     3:    276     0     0     0   724
     4:      0     0     0  1000     0
     5:      0     0  1000     0     0
    SUM   1536     0  1000  1204  1260
    CAND     1     2     3     4     5
```

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Figure 3a.

```
STRUCTURED FLOW CHARTS (N-S DIAGRAMS)

LEGEND

sequence                    loop
----------                  ------------------------
| step 1 |                  | condition to continue |
----------                  |    ------------------|
| step 2 |                  |    |  loop body       |
----------                  ------------------------

 branch                     refinement
-----------------           ----------------------
|      cdn?      |          | goal of | methods  |
|ves          no |          |         | used to  |
|-------|-------|          | section | achieve  |
|true   | false |          |         | goal     |
|branch | branch|          ----------------------
-----------------
```

Figure 3b.

```
Main logic
(numbers are subroutine locations)
-----------------------------
|Read ballots (8000)        |
|---------------------------|
|Distribute points to       |
|first choices (9000)       |
|---------------------------|
|Calculate: sums, winners,  |
|quota, active candidates   |
| (4000)                    |
|---------------------------|
|Print report (5000)        |
|---------------------------|
|while winners < vacancies  |
| and active > vacancies    |
|   |-----------------------|
|   | Find whose points are |
|   | to be transferred     |
|   | and what fraction of  |
|   | them (2000)           |
|   |-----------------------|
|   |     Are there points  |
|   |        to transfer?   |
|   |ves                 no |
|   |-----------------|-----|
|   | Transfer (3000) |     |
|   |-----------------|     |
|   |Calculate (4000) |     |
|   |-----------------|     |
|   | Print report    |     |
|   | (5000)          |     |
|---------------------------|
```

Conducting an Election

Various sets of rules for carrying out the tallies are in use, and could conceivably give different results in some elections so it is important to adopt explicit rules before the election to avoid arguments afterward. One way would be to adopt the rules contained in the attached program. A copy of some rules for manual counting is available from the city of Cambridge, MA (2).

Every group that might want representation should have one or more candidates running. STV imposes no penalty on a group for nominating more candidates than it can elect. The votes of their losing candidates will be transferred to their stronger ones. You might want to allow as candidates everyone who has a certain number of petition signatures; everyone whose name is proposed and who does not decline; or even everyone eligible who has not declined.

Each voter ranks the candidates according to his preference, for instance by taking a list of the candidates' names and marking beside each name its rank: 1 beside the favorite, 2 beside the second choice, and so on (Figure 1). Ranking only the first few choices indicates no preference among the unranked candidates. If a voter's object is to make sure that Whyte doesn't get elected, then he must rank all other candidates, ranking Whyte last or not at all.

You will have to decide what to do about various kinds of irregular ballots. For instance, if someone ranks candidates as 1, 3, and 4, but doesn't use 2, you might decide his 3 really meant 2 and his 4 was a 3. If he had numbers 1, 2, 2, 3, you could decide at random which is 2 and which is 3, and make the 3 a 4. Such decisions should be known to the voters before the election.

Suppose you adopt the attached program as your counting rule. The program identifies each candidate by a number from 1 to the number of candidates. Assign candidate numbers in a random order, to randomize the tie-breaking process in the program.

The first data statement has the number of positions to be filled and the number of candidates. Each succeeding data statement represents a ballot, assigning to each candidate numbers based on the preference order of that ballot, and ending with a zero. The last data statement contains the number -1, to signal the end of the data.

Check the array dimensions. The first dimension of BALLOT is the number of ballots, the second at least one more than the number of candidates. Dimensions of SUM and Z are the number of candidates. The dimensions of TALLY are the number of ballots and the number of candidates.

The output shows what you need to know to tell why the program decided to make the transfers it did. If you requested detailed tallies, then you also get a table for each tally showing how many points of each ballot have been given to each candidate. Sums are done in real precision, but the table is printed out rounded off, so the sums may sometimes appear to be off by one or two points. If points of a ballot are to be transferred from candidate X but the ballot indicates no further choices after X, then those points become invalid, and are given to a fictitious "candidate 0." Invalid points no longer count in the election, so the number of points required to win (the "quota") becomes smaller.

The Sample Election

There are five candidates to fill three positions, and five voters. Their ballots are shown in Figure 1. DATA statement 11010 represents the first ballot, and shows that its first choice is candidate number one, Baker; second choice is number 5, Arnold; third is number two, Park; and the last two choices are numbers four and three, Meyer and Moreno.

The second tally is not displayed; it is identical to the first, since candidate number 2 had no points to transfer. From the final tally (Figure 2), we see that the winners are candidates 1, 4, and 5: Baker, Meyer and Arnold. The 60% majority (the first three ballots) got 67% of the seats, and the 40% minority got 33%; even though the minority "split their vote" between Meyer and Moreno.

Program Details

The attached program should run as is, or with the variable names abbreviated, on just about any version of Basic with floating-point arithmetic and two-subscript arrays. You can probably tune it up to be more efficient using features of your particular Basic. On a 48K Apple II Plus it runs as is for about 200 ballots for ten candidates or 300 ballots for six candidates, in about six to eight minutes for random ballots.

The program saves time by not transferring surplus points unless the total

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Every Vote, continued...

Figure 3c.

```
2000 Find whose votes to transfer, and what fraction of them.
-------------------------------------------------------------
| Find the                 | Set high and low to first      |
| highest                  | active candidate, 2d low       |
| and two                  | to fake one with quota         |
| lowest                   | for rest of candidates         |
| candidates               |   active?                      |
|                          |   yes                    no    |
|                          |   if higher than high,         |
|                          |   change high.                 |
|                          |   if lower than L2,            |
|                          |   change L2                    |
|                          |   if low, L2 are out of        |
|                          |   order, change them.          |
| Summarize                | calculate difference of        |
|                          | two lows, print summary        |
| Decide whether           |   enough surplus to            |
| to transfer              |   transfer?                    |
| surplus of               | yes                        no  |
| high candidate           | giver = high | giver = low     |
| or eliminate             | calculate    | fraction = 1    |
| low, calculate           | fraction to  | status = -1     |
| fraction to              | transfer     | print facts     |
| transfer, set            |                                |
| status.                  |                                |
-------------------------------------------------------------
```

Figure 3d.

```
3000 transfer giver's points
-------------------------------------------------------------
| for each ballot                                           |
|   any points?                                             |
|   yes                                                 no  |
|   find rank of giver                                      |
|   on this ballot                                          |
|   find next eligible                                      |
|   choice on this                                          |
|   ballot (or 0)                                           |
|   transfer fraction                                       |
|   of giver's points                                       |
|   to next eligible                                        |
|   choice                                                  |
-------------------------------------------------------------
```

Figure 3e.

```
4000 calculate
-------------------------------------------------------------
| find sum for each        | set grand sum to 0             |
| candidate and sum        | for each candidate             |
| of all valid points.     |   set his/her sum to 0         |
|                          |   active?                      |
|                          |   yes                    no    |
|                          |   add his/her points           |
|                          |   from all ballots             |
|                          |   add to grand sum             |
| calculate quota          | calculate quota                |
|                          | set winners, active, total     |
| find number of           | surplus all to zero.           |
| winners, number of       | for each candidate             |
| active candidates,       |   over quota?                  |
| total surplus            |   yes                    no    |
|                          |   status = 1                   |
|                          |   add surplus to               |
|                          |   total surplus                |
|                          |   increment winners if         |
|                          |   status = 1                   |
|                          |   increment active if          |
|                          |   status is not -1             |
-------------------------------------------------------------
```

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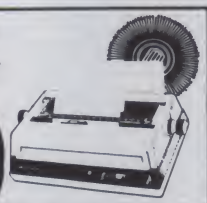

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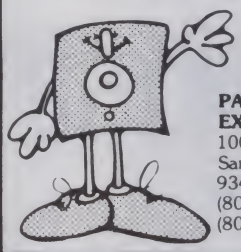

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CIRCLE 120 ON READER SERVICE CARD

Dictionary Of Variables

AMOUNT: Amount of this candidate's vote to be transferred.
BLTNO: Number of this ballot.
B9: Total number of ballots.
BALLOT (BLTNO,RANK): Number of candidate ranked RANK on ballot number BLTNO.
CNDNO: Number of this candidate.
C9: Total number of candidates.
C8: Number of candidates not eliminated.
DFF: Difference between sums of two lowest candidates.
D$: Detail flag: "Y" means print details of tallies.
FRACT: Fraction of GIVER's vote to be transferred.
GIVER: Number of candidate whose votes are to be transferred.
HIGH: Number of candidate with highest sum.
ITER: Iteration number (tally number).
KOLUMS: Column width for print subroutine.
K2: Counter for print subroutine.
LOW: Number of candidate with lowest sum.
L2: Number of candidate with second lowest sum.
QUOTA: Quota.
RANK: Position on someone's ballot.
SUM: Total of all valid points.
SUM (CNDNDO): Total points for candidate number CNDNO.
S2: Total surplus of winners.
TALLY (BLTNO, CNDNO): Number of points of ballot BLTNO being counted for candidate number CNDNO.
VACANCIES: Number of positions to be filled by the election.
WINNERS: Number of candidates already declared winner.
X: Value to be printed by subroutine.
Z (CNDNO): "Ztatus" of candidate number CNDNO:
-1 eliminated
0 still eligible, not elected
1 elected

Listing 1.

```
100  REM  SINGLE TRANSFERABLE
110  REM      VOTE
120  REM  COUNTING PROGRAM
130  REM  J T PARR  MAY 1982
140  REM  PERMISSION TO USE,
150  REM  NOT SELL.
160  REM  REFERENCE:
170  REM   HOW DEMOCRACIES VOTE
180  REM   BY ENID LAKEMAN,
190  REM   FABER & FABER
192  REM   LONDON 1974
195  REM ----------------------
210  REM  ALL VARIABLES MAY BE
211  REM  SHORTENED TO FIRST
212  REM  LETTER OR LETTER
213  REM  AND DIGIT.
290  REM ----------------------
500  DIM BALLOT(31,14)
510  DIM SUM(14)
520  DIM TALLY(31,13)
540  DIM Z(13)
550  LET KOLUMS = 5
1000  REM ----------------------
1010  REM   C O N T R O L
1020  REM ----------------------
1050  PRINT "DISPLAY DETAILED TALLIES (Y/N)";
1060  INPUT D$
1100  REM   R E A D   V O T E S
1110  GOSUB 8000
1150  REM   1 S T  C H O I C E S
```

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surplus exceeds a "threshold" of ten points, and is enough to allow the trailing candidate to catch up to the next one. In the sample election, if surplus had been redistributed whenever it was over ten points, there would have been ten tallies instead of six. If the threshold had been one point instead of ten, it would have taken 14 tallies.

History

The most flexible method of proportional representation, the Single Transferable Vote, was invented independently by Andrae in Denmark in 1855 and by Thomas Hare in England in 1857. It is used in public elections in the Republic of Ireland, Northern Ireland, Australia, New Zealand, several cities in Canada, in the Church of England, and in many private societies.

In the United States, proportional representation in the form of STV has been used notably in municipal elections in Cincinnati, New York City and Cambridge, MA. It is still used in Cambridge and in the New York City school board elections.

Cincinnati and New York have similar histories in the use of proportional representation. Both adopted STV as part of a reform in reaction to a party machine that held power out of proportion to its numbers. In both cases, on the council elected under STV, seats were held by the machine and other groups in proportion to their voting strength. In both cases, the machine attempted repeatedly to repeal STV, succeeding finally when voters were alarmed by an unpopular group gaining a seat. New York used STV for ten years, Cincinnati for 33.

Some Pros And Cons

The ideal of democracy is the entire population debating and voting on issues. STV comes close to that ideal by providing a representative body in which opinions on major issues are present in the same proportions as in the population. It provides an automatic responsiveness to new issues and new coalitions. However, it is harder to explain to voters, and more complicated to carry out.

A small city is perhaps an ideal place to try STV. Most city councils are elected either at large or from wards. The usual at-large election can allow a plurality to win all the seats. Using wards or districts guarantees representation to some groups that are concentrated geographically, but a large minority spread evenly through the city could still be without representation. Elections at large by STV would assure them representation regardless of where they live.

A state legislature would be too large for a single ballot. One could group

```
1160  GOSUB 9000
1200  REM  C O U N T   V O T E S
1201  REM    &  W I N N E R S
1210  GOSUB 4000
1220  REM   R E P O R T
1225  LET ITER = 1
1230  GOSUB 5000
1300  FOR ITER = 2 TO 1E15
1305  IF WINNERS >  = VACANCIES OR C8 <  = VACANCIES THEN 1900
1310  REM   F I N D   G I V E R
1320  GOSUB 2000
1330  IF SUM(GIVER) < .5 THEN 1800
1600  REM   R E T A L L Y
1610  GOSUB 3000
1620  REM   S U M  U P
1630  GOSUB 4000
1640  REM   R E P O R T
1650  GOSUB 5000
1800  NEXT ITER
1900  REM
1999  STOP
2000  REM ----------------------
2010  REM  FIND HIGH, LOW
2020  REM -----------------------
2030  FOR CNDNO = 1 TO C9
2040  IF Z(CNDNO) >  - 1 THEN 2060
2050  NEXT CNDNO
2060  LET HIGH = CNDNO
2070  LET LOW = CNDNO
2080  LET L2 = C9 + 1
2090  LET SUM(C9 + 1) = QUOTA
2100  FOR CNDNO = CNDNO + 1 TO C9
2110  IF Z(CNDNO) =  - 1 THEN 2200
2120  IF SUM(CNDNO) <  = SUM(HIGH) THEN 2140
2130  LET HIGH = CNDNO
2140  REM
2150  IF SUM(CNDNO) >  = SUM(L2) THEN 2200
2160  LET L2 = CNDNO
2170  IF SUM(LOW) <  = SUM(L2) THEN 2200
2180  LET L2 = LOW
2190  LET LOW = CNDNO
2200  REM
2210  NEXT CNDNO
2300  REM
2310  PRINT "HIGH = ";HIGH;
2320  PRINT "; LOWS = ";LOW;" ";L2
2330  LET DFF = SUM(L2) - SUM(LOW)
2340  PRINT "TOTAL SURPLUS = "; INT (S2 + .5);"; DIFFERENCE =
"; INT (DFF + .5)
2350  REM  HIGH OR LOW?
2360  IF S2 > DFF AND S2 > 10 THEN 2500
2370  REM
2400  REM NO SURPLUS; DROP LOW
2410  LET GIVER = LOW
2420  LET Z(LOW) =  - 1
2430  LET FRACT = 1
2440  PRINT "ELIMINATE CANDIDATE ";LOW
2450  GOTO 2600
2460  REM
2500  REM  REDIST HIGH
2510  LET GIVER = HIGH
2520  LET FRACT = 1 - QUOTA / SUM(HIGH)
2530  PRINT "DISTRIBUTE EXCESS OF CANDIDATE ";HIGH
2600  REM  END OF BRANCH
2610  RETURN
3000  REM ----------------------
3010  REM  TRANSFER POINTS
3020  REM ----------------------
3060  FOR BLTNO = 1 TO B9
3070  IF TALLY(BLTNO,GIVER) < .5 THEN 3340
3075  REM
3100  REM   FIND BLTNO'S  NEXT
3110  REM  ELIGIBLE CHOICE
3120  REM  AFTER GIVER.
```

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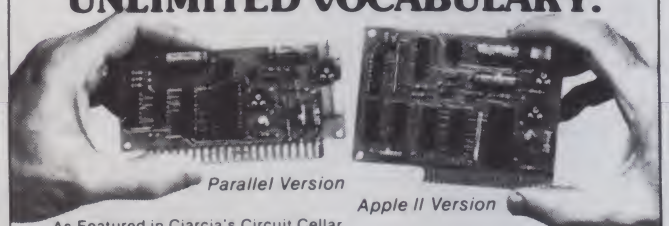

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several (say, five) of the present districts into "super-districts" in which five representatives would be elected at large by STV.

Summary

STV is a system which holds considerable promise for providing better representation in many kinds of elections. If you have questions about how it would operate under certain circumstances, make up a set of ballots and run the program to find out. If you find the system attractive, maybe you can start it in your organizations. □

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```
3130  FOR RANK = 1 TO C9
3140  IF BALLOT(BLTNO,RANK) = GIVER THEN 3180
3150  NEXT RANK
3160  REM  GIVER NOT ON BALLOT
3170  GOTO 3340
3180  REM  GIVER FOUND AT RANK
3190  FOR RANK = RANK + 1 TO C9 + 1
3200  LET CNDNO = BALLOT(BLTNO,RANK)
3210  IF Z(CNDNO) >  - 1 THEN 3240
3220  IF CNDNO = 0 THEN 3240
3230  NEXT RANK
3240  REM
3300  REM  GIVE SURPLUS TO CNDNO
3310  LET AMOUNT = FRACT * TALLY(BLTNO,GIVER)
3320  LET TALLY(BLTNO,CNDNO) = TALLY(BLTNO,CNDNO) + AMOUNT
3330  LET TALLY(BLTNO,GIVER) = TALLY(BLTNO,GIVER) - AMOUNT
3340  REM
3350  NEXT BLTNO
3360  RETURN
4000  REM --------------------
4001  REM  TOTALS, QUOTA AND
4002  REM    WINNERS.
4003  REM --------------------
4010  LET SUM = 0
4020  FOR CNDNO = 1 TO C9
4030  LET SUM(CNDNO) = 0
4040  IF Z(CNDNO) =  - 1 THEN 4090
4050  FOR BLTNO = 1 TO B9
4060  LET SUM(CNDNO) = SUM(CNDNO) + TALLY(BLTNO,CNDNO)
4070  NEXT BLTNO
4080  LET SUM = SUM + SUM(CNDNO)
4090  NEXT CNDNO
4099  REM
4100  REM   Q U O T A
4110  LET QUOTA = 10 + SUM / (VACANCIES + 1)
4120  REM
4130  REM  W I N N E R S
4140  LET WINNERS = 0
4150  LET C8 = 0
4160  LET S2 = 0
4170  FOR CNDNO = 1 TO C9
4180  IF (SUM(CNDNO) < QUOTA) THEN 4210
4190  LET Z(CNDNO) = 1
4200  LET S2 = S2 + SUM(CNDNO) - QUOTA
4210  REM
4220  IF Z(CNDNO) < 1 THEN 4240
4230  LET WINNERS = WINNERS + 1
4240  REM
4250  IF Z(CNDNO) =  - 1 THEN 4270
4260  LET C8 = C8 + 1
4270  REM
4280  NEXT CNDNO
4290  RETURN
5000  REM ---------------------
5001  REM    R E P O R T
5002  REM ---------------------
5010  PRINT
5020  PRINT "TALLY NUMBER ";ITER
5030  LET KOLUMS = 5
5040  IF D$ <  > "Y" THEN 5220
5090  REM
5100  REM   D E T A I L S
5110  PRINT
5120  FOR BLTNO = 1 TO B9
5130  LET X = BLTNO
5140  GOSUB 7000
5150  PRINT ": ";
5160  FOR CNDNO = 1 TO C9
5170  LET X = TALLY(BLTNO,CNDNO)
5180  GOSUB 7000
5190  NEXT CNDNO
5200  PRINT
5210  NEXT BLTNO
5220  REM
```

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7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
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88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
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93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
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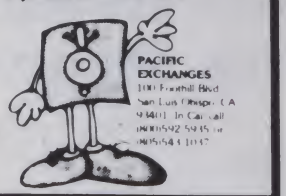

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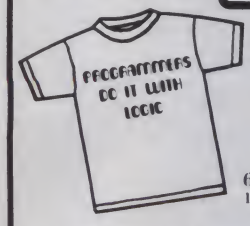

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5500  REM   S U M M A R Y
5510  PRINT  TAB( KOLUMS);"SUM ";
5520  FOR CNDNO = 1 TO C9
5530  LET X = SUM(CNDNO)
5540  GOSUB 7000
5550  NEXT CNDNO
5560  PRINT
5600  PRINT  TAB( KOLUMS);"CAND";
5610  FOR CNDNO = 1 TO C9
5620  LET X = CNDNO
5630  GOSUB 7000
5640  NEXT CNDNO
5650  PRINT
5710  PRINT "QUOTA = ";QUOTA;": ";WINNERS;" WINNERS: ";
5720  FOR CNDNO = 1 TO C9
5730  IF Z(CNDNO) <  > 1 THEN 5750
5740  PRINT CNDNO;" ";
5750  NEXT CNDNO
5760  PRINT
5770  RETURN
7000  REM --------------------
7002  REM  PRINT NUMBER IN
7003  REM       KOLUMS
7004  REM --------------------
7010  LET X =  INT (X + .5)
7020  FOR K1 = 1 TO KOLUMS
7030  IF X >  = 10 ^ K1 - .1 THEN 7050
7040  PRINT " ";
7050  NEXT K1
7060  PRINT X;
7070  RETURN
8000  REM --------------------
8010  REM  R E A D   D A T A
8020  REM --------------------
8030  READ VACANCIES,C9
8040  PRINT
8050  PRINT "BALLOTS"
8055  LET KOLUMS = 2
8060  FOR BLTNO = 1 TO 1E13
8070  FOR RANK = 1 TO C9 + 1
8080  READ CNDNO
8090  IF CNDNO <  = 0 THEN 8120
8100  LET BALLOT(BLTNO,RANK) = CNDNO
8110  NEXT RANK
8120  REM
8130  IF CNDNO < 0 THEN 8200
8140  PRINT BLTNO; TAB( 3);":";
8150  FOR RANK = 1 TO C9
8160  LET X = BALLOT(BLTNO,RANK)
8165  GOSUB 7000
8168  IF X <  = 0 THEN 8180
8170  NEXT RANK
8180  PRINT
8190  NEXT BLTNO
8200  REM --- NO MORE DATA
8210  LET B9 = BLTNO - 1
8220  RETURN
9000  REM
9010  REM  INIT TALLY
9020  REM
9030  FOR BLTNO = 1 TO B9
9040  LET TALLY(BLTNO,BALLOT(BLTNO,1)) = 1000
9050  NEXT BLTNO
9060  RETURN
10000  REM --------------------
10001  REM  DATA STATEMENTS
10002  REM  VACANCIES,
10003  REM    CANDIDATES.
10004  REM  EACH BALLOT, END-
10005  REM  ING WITH 0.
10006  REM  -1 AT THE END OF
10007  REM  THE BALLOTS.
10008  REM --------------------
55550  DATA  -1
55555  END
```

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#1413	Datalink (disk)	$33.84
#1414	Tach-Master (disk)	$25.44
#1415	Programming Aids I (cass.)	$12.64
#1416	Programming Aids I (disk)	$16.84
#1417	Swifty Utilities (disk)	$25.44
#1418	Disk Sentry (hardware)	$33.84
#1419	800 black dust cover	$12.64
#1420	810 black dust cover	$11.44

MORE ATARI

All APX, including Eastern Front, Attank!, Wordmaker, Number Blast, 747 Landing Simulator, and many more available at 15% off list price (most available in cassette and disk).

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#290	Centipede	$38.14
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#980	K-razy Shootout (cart.)	$42.44
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#461	Wizard and the Princess (disk)	$27.94
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#1171	Deluxe Invaders (cart.)	$33.94
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#1141	Space Eggs	$25.44
#1192	Black Forest (disk)	$21.14
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#667	Nautilus (disk)	$25.44
#666	Chicken (cass.)	$25.44
#665	Chicken (disk)	$25.44
#664	Protector (cass.)	$25.44
#663	Protector (disk)	$25.44
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Softlights

By Fred Huntington

Finally – Time for the Great Grandma Huntington sayings contest winners. Congratulations to Hartley Lesser of New Hampshire and L. R. Bergsieker of St. Louis. They each win a geunine Epson watch.

Here are some of the sayings L. R. Bergsieker submitted:

Great Grandma Huntington says:

- A barking drive never bytes.
- Hell hath no fury like an accidental reset.
- All good things come to he who jumps to $FCA8.
- There are a number of things that can fail, but they're usually in hex.
- All family trees have at least one bad branch error.
- You can't get serial output from a cornflakes box.

And now some of the repartee from Great Grandma Huntington courtesy Hartley Lesser:

- Said Great Grandma Huntington of her grandson upon the day of his birth, "My goodness, he's a bit off the old chip."
- There is absolutely no truth to the rumor that Great Grandma is too involved in computing. Just because all were invited to a Thanksgiving turnkey dinner means nothing.
- Great Grandma Huntington was in a real fix. She has just completed entry an important letter into a word processor, but couldn't get the printer to function properly. Exasperated, she finally shrugged her shoulders and gave up. "Someday my prints will come," she muttered on her way for help.

Many thanks to all those who entered. We'll be printing more Great Grandma sayings in the future. Look next year for our first book publishing effort, The First Collection of Great Grandma Sayings.

If you still have some good sayings or jokes, send them in and the best ones will be used in the forthcoming book. Any sayings used will earn a Great Grandma Tee-shirt for its author. All entries become the property of Huntington Computing and will not be returned

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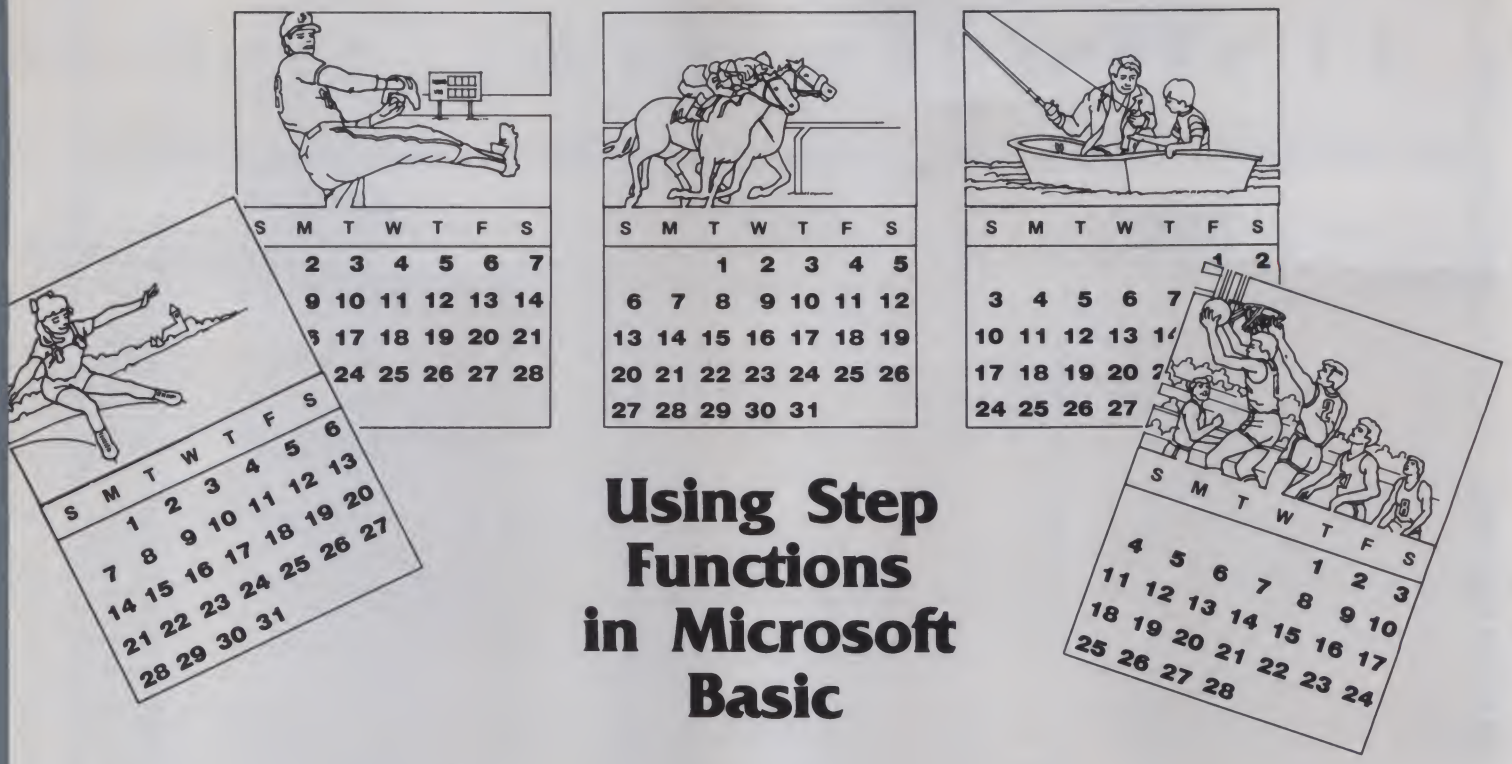

Using Step Functions in Microsoft Basic

Daniel Smith

A little known feature of Microsoft Basic interpreters is their ability to treat boolean expressions as numbers. For example, the statement:

PRINT (1=1), (2<1)

yields the results -1 and 0. When told to print the expressions, Basic arrives at the boolean result and returns it to the PRINT statement as a number. True expressions return - 1 because the interpreter represents true as 11111111 binary, and that is the numerical value for -1. False expressions return 0 because false is represented as 0.

This feature can be used to build compact step functions. A step function is an equation that is built in increments of 1.

Step functions are valuable tools for mathematicians because you can approximate any curve with a step function if you make it long enough. For example, a square wave is a crude approximation of a sine wave. You can improve the approximation by using shorter and shorter steps, until you arrive at a sine wave that looks like a staircase. Continue the process and eventually the eye cannot tell the difference between the sine function and the step function.

Bar graphs are all step functions. Step functions are commonly found in mathematical modeling and statistical analysis. In fact, whenever you are trying to fit a curve to data with a computer, it is often easier and more accurate to represent it with a step function than with a formula.

So, how do you use boolean arithmetic to build a step function? Boolean expressions return 0 or 1. (In our case -1, but we can drop the sign several ways.) Consider the expression X* (Y<5). If Y is less than 5, X will be multiplied by 0 and vanish. If Y is 5 or more, the expression reduces to -X.

To demonstrate how useful this technique can be, let's use it to convert dates from month-day-year format to Julian dates. (For example, February 17 is day 48 in Julian format.)

We begin with an approximation. The average month is about 30.42 days long. Let M=month, D=day, Y=year, and J=Julian day. The Julian date should be about:

J=INT((M-1)*30.42) +D

Next we look at specifics. February 28 is Julian 59, but our formula yields 58, so we add a day for February dates. Note that we subtract to convert that pesky -1 to 1. You may prefer to use an ABS function.

J=INT((M-1)*30.42) -(M=2) +D

Now we notice that if the month is between March and July, our formula yields a date one day too big. We compensate:

J=INT((M-1)*30.42-(M=2)+
(M>2 AND M<8)+D

Now the formula works unless it is a leap year. If it is a leap year and the month is March or later we need to add a day:

J=INT((M-1)*30.42)-(M=2)+(M>2
AND M<8)-(M>2 AND
INT(Y/4 *4=Y)+D

There. A one line Julian conversion equation.

In business applications we often need to find the distance between two dates. In fact, entire legions of programmers are planning a one year leave of absence commencing December 31, 1999, when their date routines crash into the new century.

Say you want to prepare a 30-60-90 day aging report. Julian dates are clumsy to work with in the period from November to February. One way to handle the problem is to convert the date into the number of days from a common reference point, say the start of the century. Call it C.

C=J+365*Y+INT((Y-1)/4)+1

Given C, we can derive other useful functions, including functions to convert back into month-day-year format.

To demonstrate the technique, we prepared a short program that prints

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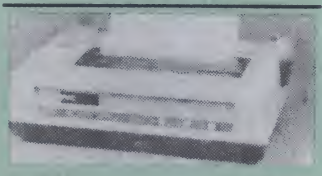

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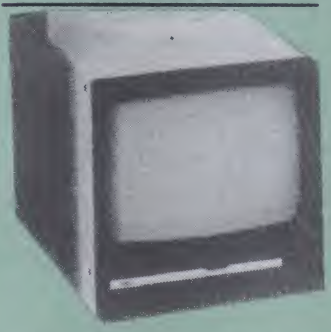

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Step Functions, continued...

calendars. You supply a year between 1900 and 1999. The program was developed on an OSI C3-OEM, but it should work on any computer that uses a Microsoft Basic interpreter—Apple, TRS-80, PET, etc.

Statements using boolean expressions have been flagged with remarks. Notice that the FOR-NEXT loop in line 1070 identifies leap years with a step function. The program requires only 27 lines of code.

Of course, while other languages do allow boolean expressions as part of arithmetic equations, it is not a standard feature of Basic. You should use the technique with care, and document each occurrence with a remark. But the technique is simple, easily understood, and can save you many lines of code. ☐

```
1000 REM CALENDAR - PREPARES CALENDARS USING STEP FUNCTIONS
1010 DATA JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, JULY, AUGUST
1020 DATA SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER
1030 DIM MO$(12) : FOR I=1 TO 12 :READ MO$(I) :NEXT
1040 INPUT"ENTER YEAR (1900-1999)";Y :Y=Y-1900
1050 D=1 :M=1 :GOSUB 2000:REM GET JULIAN AND #DAYS SINCE 01/01/1900
1060 PRINT#P,TAB(20);1900+Y :PRINT#P,TAB(21)"----"
1070 FOR I=C TO C+364 -(Y=INT(Y/4)*4)                    :REM STEP
1080 C=I :GOSUB 3000 :REM GET M,D,Y
1090 IF D=1 THEN PRINT#P :PRINT#P :PRINT#P,TAB(20);MO$(M)
1100 W=I-INT(I/7)*7-7*(I=INT(I/7)*7)                     :REM STEP
1110 PRINT#P,TAB((W+1)*4);D; :IF W=7 THEN PRINT#P
1120 NEXTI
1130 END
2000 REM GIVEN M,D,Y RETURN J=JULIAN DAY AND C=#DAYS SINCE 01/01/1900
2010 J=INT(30.42*(M-1)) -(M=2) +(M>2 AND M<8) -(M>2 AND INT(Y/4)*4=Y)+D
2020 C=J+365*Y+INT((Y-1)/4)+1
2030 RETURN
3000 REM GIVEN C=#DAYS SINCE 01/01/1900, RETURN J=JULIAN, M,D,Y
3010 L=INT(C/1461.1):REM #LEAP YEARS SINCE 1900
3020 Y=L*4-(C>(L*1461)+366)*(INT((C-L*1461-366)/365.1)+1):REM STEP
3030 J=C-Y*365 -INT(Y/4)+(Y>0) -(INT(Y/4)*4=Y)           :REM STEP
3040 M=J +(J>59 AND INT(Y/4)*4=Y)                        :REM STEPS
3050 M=INT(M/30.42)+1 -(M=60) +(M=31) -(M=91 OR M=121 OR M=152 OR M=182)
3060 D=1 :I=C :J1=J :GOSUB2000 :J=J1 :REM FIND C FOR 01/M/Y
3070 D=I-C+1
3080 RETURN
```


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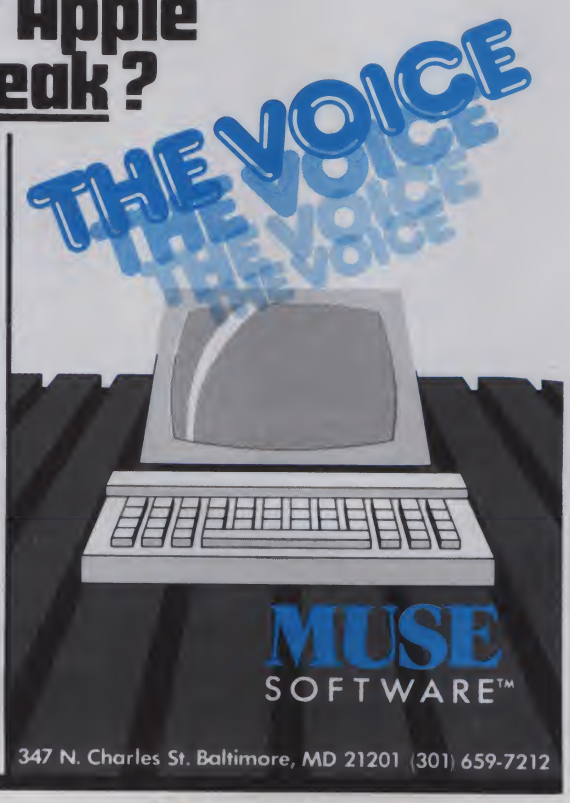

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CIRCLE 113 ON READER SERVICE CARD

INTBASIC LIVES!

A while back, Creative Computing showed how to move the mini-assembler so it could be used in an Apple II Plus without a language card. Here we describe how to move the rest of Integer Basic.

Wally Hubbard

"Unfair!" I thought. My DOS 3.3 System Master disk had a program called INTBASIC on it, but no way to run it. I had a 48K Apple, but no language card to stick into it. Just typing BLOAD INTBASIC produced nothing worthwhile. But there it was. INTBASIC. Smiling at me every time I typed CATALOG. Would I ever find out what Applevision was? Or survive without charting my Biorhythms? Or play Animals?

Actually, moving INTBASIC and getting it to work somewhere else in memory is a kind of puzzle any computer hacker would enjoy (at least the first time through). So thanks, Apple, for putting it on the disk.

I now have a working version of Integer Basic that resides at $6C00 and works with DOS. A collection of the information needed for you to get the same thing follows.

There are four listings. The first is a machine language program that makes most of the changes that are needed. Listing 2 shows the changes that must be made next. Listing 3 shows the changes that must be made to DOS 3.3. The last listing shows a HELLO program that can be used to INIT a new diskette, which you must do to record the altered DOS.

Wally Hubbard, 3174-321 Pheasant Run Drive, LaFayette, IN 47905.

Each listing shows exactly what you should type for a 48K Apple II Plus. I shall explain later what to change to use INTBASIC elsewhere.

Listing 1. First make sure you have a good copy of DOS 3.3 in memory then put INTBASIC into the memory area starting at $3000. Enter the monitor and key in the machine language program. It will work anywhere, but I show it being entered at $300 to $35C. Check to make sure you copied it correctly, then start it running.

Listing 1.

```
]BLOAD INTBASIC,A$3000
]CALL-151
*300:A9 4A 85 FB A9 00 85 FA
*308:A0 80 B1 FA 10 05 38 E9
*310:64 91 FA C8 D0 F4 84 FC
*318:84 3A A9 60 85 FD A9 30
*320:85 3B A5 25 20 C1 FB A6
*328:28 86 FE A6 29 86 FF 20
*330:D0 F8 A0 0E A9 C3 D1 FE
*338:90 10 20 53 F9 85 3A 84
*340:3B C4 FD D0 DD C5 FC 90
*348:D9 60 A0 02 B1 3A 38 E9
*350:64 91 3A 20 D0 F8 20 8E
*358:FD A9 00 F0 DD
*300G
```

The machine language program does two things. First it changes a jump table that Integer Basic uses to find where it must go to perform a command. The high address bytes in the table are now stored between $4A80 and $4AFF.

Since INTBASIC will be moved so that its starting address is $6C00 instead of $D000, the difference, $6400, is subtracted from each address in the table. The process is simplified by just subtracting $64 from each high byte and leaving the low address bytes (located from $4A00 to $4A7F) alone.

Next, in a four-minute extravaganza, the INTBASIC program is disassembled on your screen. Whenever a three-byte instruction is displayed and the third byte is greater than or equal to $D0, $64 is subtracted from it. Each time this happens, the revised instruction is redisplayed and followed by a blank line. When the program is finished, it has made 936 changes to INTBASIC.

Listing 2. Unfortunately, the work done in Listing 1 is defective. Some of the text and jump table bytes are changed, and some jump table bytes that should have been changed were missed. The disassembler can't tell instructions from jump tables or text. Sixteen corrections

Listing 2.

```
*31EE:F4
*31F1:D4
*3410:D8
*34B1:F5
*34A0:DC
*3CF9:D0
*40B0:B9
*44B4:44
*4A0D:E2
*4A5A:D8
*4B0E:D3
*4B11:D4
*4B25:D0
*4D6A:EC
*4DB1:DD
*4DD8:F7
*5010:A9 6C 85 4D D0 0C
*5A19:F4
*5A88:EA EA
*5A95:7C
*5AFE:96
*5B00:7C
*5B1D:D3
*5EA8:99
*5FBF:9A
*5FFD:96
*5FFF:96
```

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Eric Balkan, The Computer Consultant, Vol 2 No 9:

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are needed, along with a few more changes and some new instructions.

At $5010, new instructions are inserted that will automatically set HIMEM at $6C00 instead of $C000. This is necessary so that INTBASIC won't be wiped out the first time a program is loaded. The instructions at $5A88 eliminate cold restarts of your Apple from Integer Basic (unexpected rebooting of the disk).

Listing 3. Integer Basic is now in great shape for cassette use, but DOS isn't ready to deal with it yet. DOS will still look for a language card, and, not finding one, insist LANGUAGE NOT AVAILABLE if you try to run Integer Basic. That is where Listing 3 comes in.

The jump table at $9D62 must be changed. The instructions at $A5B2 and $A5BB must be changed so that DOS will check at the right memory location for INTBASIC and think it is there.

The message at $B3B0 (DISK VOLUME) is changed to reflect the fact that the DOS has been customized. The message will now read I/A DOS VOL each time the disk is CATALOGed. I/A stands for Integer/Applesoft. The change at $9D01 combined with the cold restart of DOS provided by the command 9D84G will cause DOS to stick its buffers below INTBASIC. That way you can change the number of buffers with the MAXFILES command and not worry about having INTBASIC wiped out.

Listing 4. Now it is time to taste the fruits of your labor. Enter the program shown, insert a new disk, and type INIT HELLO. Once the disk is initialized, type BSAVE INTBASIC 6C00, A$3000, L$3000. Then to test it all, type PR#6 (or whatever it takes to boot a disk on your system) and you should be using Integer Basic.

If you are not familiar with Integer Basic, you may be in for some confusion, since many of the Applesoft commands you have grown accustomed to are not available or have different spellings. Apple does offer a manual for Integer Basic that will be extremely helpful.

Moving INTBASIC Elsewhere

If you BLOAD INTBASIC somewhere besides $3000, you must adjust all of the addresses in Listing 2 accordingly. In Listing 1, change the bytes at $301, $31B and $31F. They contain the high bytes of the jump table, and start and end addresses in INTBASIC as it is currently located.

If you want to use INTBASIC somewhere besides $6C00, you must change the bytes at $310 and $350 in Listing One. Add $01 for each $100 decrease in the starting address. INTBASIC will not work anywhere. The starting address must have the form $XY00, where Y is even and X is any number.

You will have to change some of the bytes in Listings 2 and 3 also. Subtract $01 for each $100 decrease in the starting address. The addresses at which the bytes will have to be changed are shown in Figure 1.

By putting INTBASIC at $6C00 I have left a hole from $9C00 to $9CFF which may be used for machine language programs.

When I first got INTBASIC running I tried out the Integer programs on the Master disk. I can report that I was impressed by Applevision, bored by Animals, and amused by Biorhythm. I don't believe this attempt to chart biorhythms is very dependable. The program draws a chart that shows the day I was born was just an average day. I don't remember it, but I doubt that it was. □

References

Beneath Apple DOS, Don Worth and Pieter Lechner, Quality Software, 6660 Reseda Blvd., Suite 105, Reseda, CA 91335. Pages 7-3 and 8-32 show how to rebuild buffers and where the DISK VOLUME message is located. Many details about DOS.

Apple II Basic Programming Manual, Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014. The cover looks similar to the Applesoft tutorial, but this one shows what the Integer commands do. Mine cost about $10.

Figure 1.

$40B0 $5011 $5A95 $5AFE $5B00 $5EA8 $5FBF $5FFD $5FFF	(Subtract $01 from the contents of each locations for each $100 decrease in the starting address of INTBASIC.)
$9D63 $9D67 $9D69 $9D6B $A5BC $9D01 ($A5B6) *($A5BF)*	(As above but these addresses will be different if DOS is not in 48K. If the addresses are different, you must also change $A5B6 and $A5BF. They contain the high byte of an address in DOS itself. Subtract $01 for each $100 decrease in memory size below $C000 (48K).)
$4494	(The contents of this address must be determined by a formula: $4494 = ($40BO - 1)/2. Example: If $40BO contains 89, $4494 must contain (89 - 1)/2 = 44. This is the reason for the restriction on the location of INTBASIC—$40B0 contains the high byte of an address and must be odd.)

Listing 3.

```
*9D62:36 84 E5 A4 E3 7F 00 7C 03 7C
*A5B2:A2 E0 8E 96 9D C9 4C F0 0A
*A5BB:A2 7C 8E 96 9D C9 20 60 EA EA
*B3B0:CC CF D6 A0 D3 CF C4 A0 C1 AF C9
*9D01:6B
*9D84G
```

Listing 4.

```
]
]10  HOME
]20  PRINT "LOADING INTBASIC AT $6C00":
      PRINT : PRINT "TO USE THE MINI-A
      SSEMBLER:"
]30  PRINT "  *9266G      OR": PRINT "
      ]CALL 37478"
]35  PRINT : PRINT "HIMEM IS NORMALLY SE
      T AT $6500"
]40  PRINT  CHR$ (4);"BLOAD INTBASIC 6C0
      0,A$6C00"
]50  HOME
]60  PRINT  CHR$ (4);"INT"

(NOW INSERT A NEW DISK AND TYPE:)

]INIT HELLO
]BSAVE INTBASIC 6C00,A$3000,L$3000
```

Note that if you try to run the mini-assembler from Integer Basic using CALL 37478, you will get an error message. Integer can handle only numbers between -32767 and 32767. Use CALL -28058 instead.

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CIRCLE 293 ON READER SERVICE CARD

Build a Paddle Control for Your TRS-80 Color Computer

David H. Ahl

For playing games which require movement in only one direction a potentiometer, sometimes called a paddle control, tends to provide more precise control than a joystick. This is because a joystick rotates through an arc of about 70 degrees compared to a potentiometer with 300 degrees of rotation.

Playing any of the Invaders/Galaxian family of games with the TRS-80 Color Computer joystick tends to be an exercise in frustration. You *know* you could do better were it not for that darned joystick.

Faced with this frustration, I decided to build a set of paddles for the TRS-80 Color Computer. The cost is modest—about $8.25 each or $16.50 for a pair. Most of the parts are readily available at your neighborhood Radio Shack or electronics dealer. You might have trouble finding the 5-pin 240° D.I.N. male plug. If you order by mail, be sure to specify a 240° plug as the 180° one is much more common. The 240° plug is used on some CB rigs and is sometimes available with a 5-conductor microphone cable already attached. This is perfect, although it will cost more than if you make your own.

The existing joystick schematic is shown in Figure 1. Figure 2 shows a circuit with one potentiometer that can be switched to replace either the X or Y direction with the SPDT slide switch. This is adequate for most uses.

However, if you want to use the paddle control to play a game such as *Bustout*, you would have a problem. *Bustout* normally uses a joystick and, while the game permits movement in all directions, the main movement is usually along one axis. Hence, it would be desirable to set one direction of movement at an extreme, say the bottom of the screen, and use the paddle to control right-left movement. For this, you will need the circuit shown in Figure 3. In this circuit, a 100K ohm trimmer potentiometer is used to "permanently" set one direction while the regular potentiometer controls the other direction.

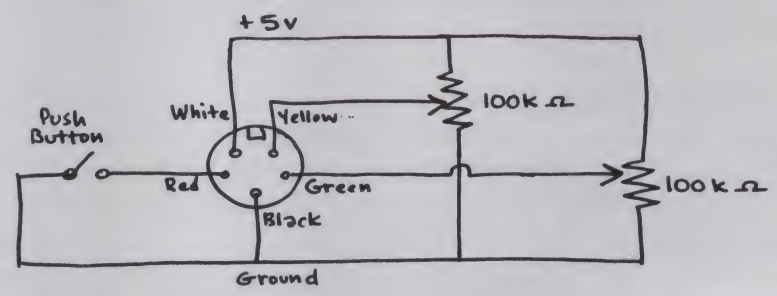

Figure 1. Existing TRS-80 Color Computer joystick schematic.

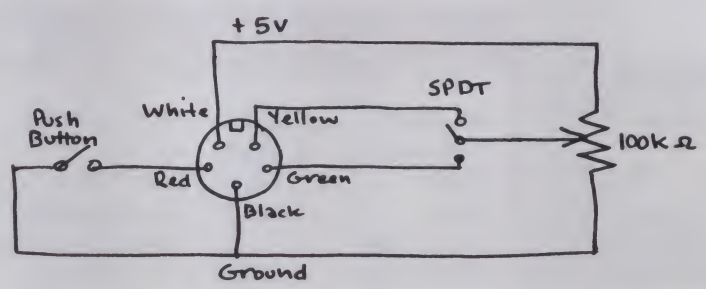

Figure 2. Schematic diagram for one potentiometer replacing one joystick direction. Unused direction is not connected.

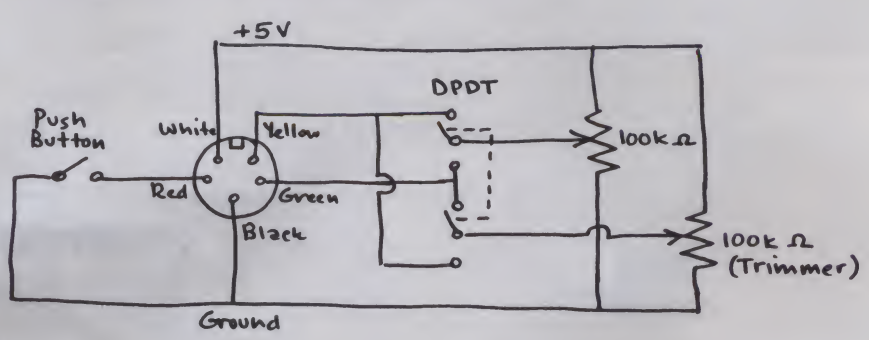

Figure 3. Schematic diagram for replacing joystick with regular and trim potentiometers.

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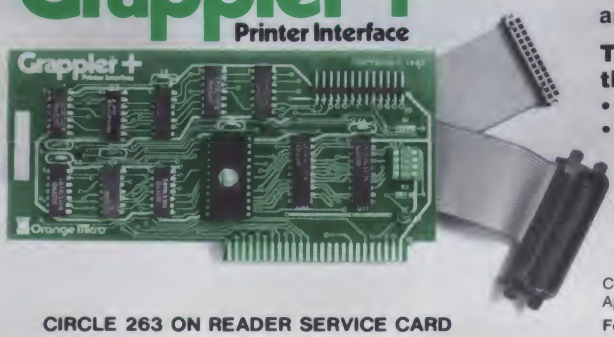

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Parts for one paddle control: cable, box, potentiometer, slide switch, resistor, disassembled D.I.N. plug.

Building the control is quite simple. Drill three pilot holes in the small plastic "project box," one in each end and one in the center of the top. With larger drills, enlarge the holes for the push button switch and potentiometer until they fit. With a small file, make a rectangular hole in one end for the slide switch. Drill mounting holes and secure the switches and pot.

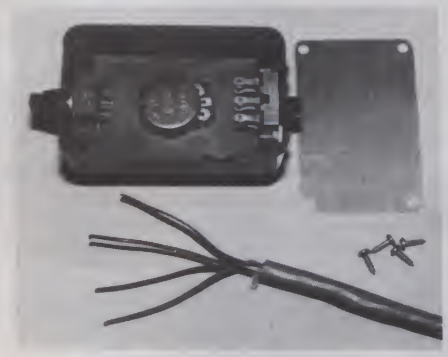
If you are building the more exotic version in Figure 3, mount the trimmer pot on either the right or left side of the box.

Use a knife or rat tail file to notch the box on the side near the slide switch for the cable.

Using short pieces of hook up wire, make all the connections except those from the cable. Then strip about two inches of outside insulation from the cable, strip and tin each wire and make these connections. Be sure to solder all connections securely—no cold solder joints please.

Connect the wires to the potentiometer as shown in Figure 4. This will insure that objects will move on the screen in a direction corresponding to potentiometer rotation.

Attach a small cable clamp to the cable where it exits the side of the box and screw the cover back on.



Push button switch, potentiometer and slide switch are mounted as shown.

Parts List (2 Paddle Controllers)

- 2 5-pin, 240° D.I.N. male plug
- 2 5-foot lengths 5-conductor stranded cable
- 2 100K ohm linear taper potentiometer
- 2 SPST momentary contact push button switch
- 2 SPDT slide switch (optional DPDT)
- 2 Mounting box (1 1/4 x 2 x 2 3/4)
- 2 1" diameter round knob
- 2 100K ohm linear taper trimmer potentiometer (optional)
- 4 6-32 screws and nuts
- 2 Small cable clamp

Strip about 1 1/2" of outer insulation from the other end of the cable. Strip about 1/16" from each wire. Disassemble the D.I.N. plug. Place the cable sheath over the cable, solder the connectors, and reassemble. Figures 1 to 3 show the D.I.N. connector viewed from the inside (cable side).

Plug in your new joysticks and test them with the following simple program:

```
5 CLS
10 PRINT @0JOYSTK(0)
20 PRINT @8JOYSTK(1)
30 PRINT @16JOYSTK(2)
40 PRINT @24JOYSTK(3)
60 GOTO 10
```

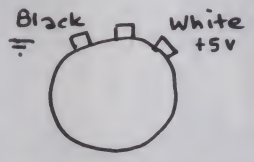
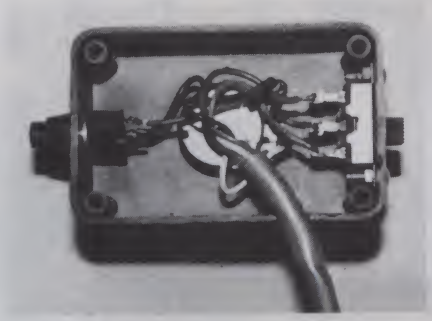


Figure 4. Rear view of potentiometer connections.



Use wires in 5-conductor cable for most internal connections.

JOYSTK 0 and 1 correspond to the right port while 2 and 3 are the left one. The slide switch should allow you to switch the right potentiometer between 0 and 1 and the left between 2 and 3. As you rotate the pot, the screen should show values between 0 and 63. If you built the circuit in Figure 2, the unused direction will generally hover between values 20 to 40. Since the connector is hanging loose and not terminated, this value is undefined.

If everything is working, get out that game of *Invaders* and prepare to rack up the highest score you've ever seen. □

Finished paddle control can be hand held or used on a table top.

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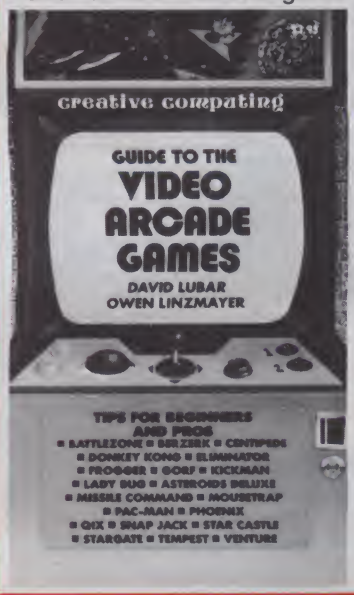

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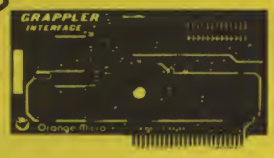

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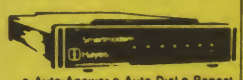

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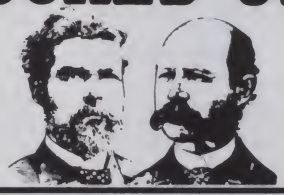

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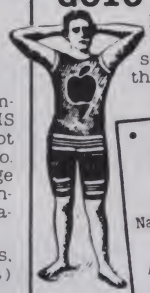

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Computer Art for the Tektronix 4052

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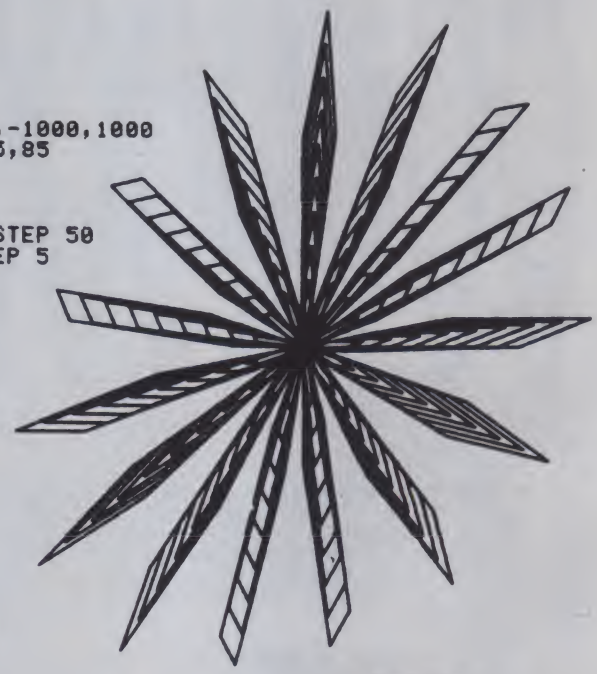
```
89 REM NOVA
100 PAGE
109 SET DEGREES
110 WINDOW -1000,1000,-1000,1000
111 VIEWPORT 20,110,15,85
112 PAGE
114 L=15
115 PAGE
120 FOR B=100 TO 500 STEP 50
130 FOR A=0 TO 360 STEP 5
140 GOSUB 180
145 IF A>0 THEN 150
146 MOVE X,Y
147 GO TO 160
150 DRAW X,Y
160 NEXT A
170 NEXT B
180 R=B*(1-SIN(L*A))
190 X=R*COS(A)
200 Y=R*SIN(A)
210 RETURN
220 END
```

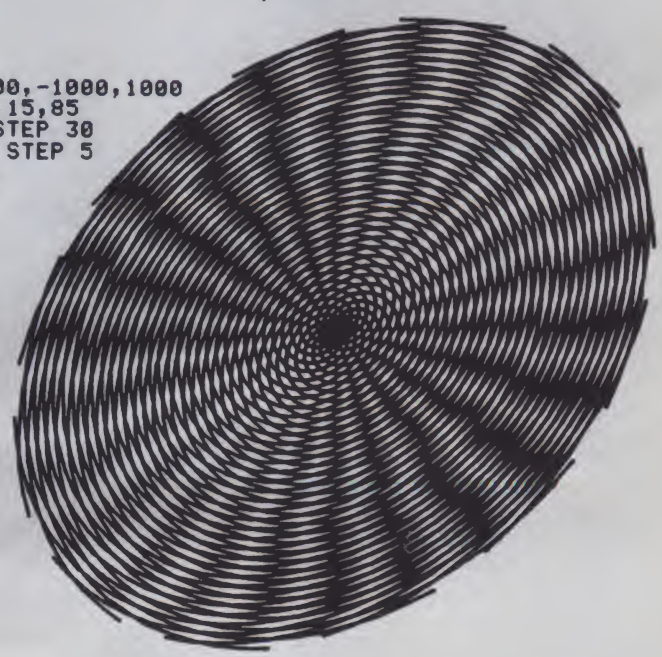


These pictures were generated on a Tektronix 4052 intelligent terminal. This device, when used in stand-alone mode, functions as a microcomputer not unlike most home computers. The main differences are that the CRT is a storage tube, screen resolution is very high, and you can easily obtain hardcopies of anything that is displayed on the screen.

The programs that were used are coded in Basic. However, the plotting commands (MOVE, WRITE, WINDOW, VIEWPORT), which are typical of graphics packages plot statements, are not standard Basic commands.

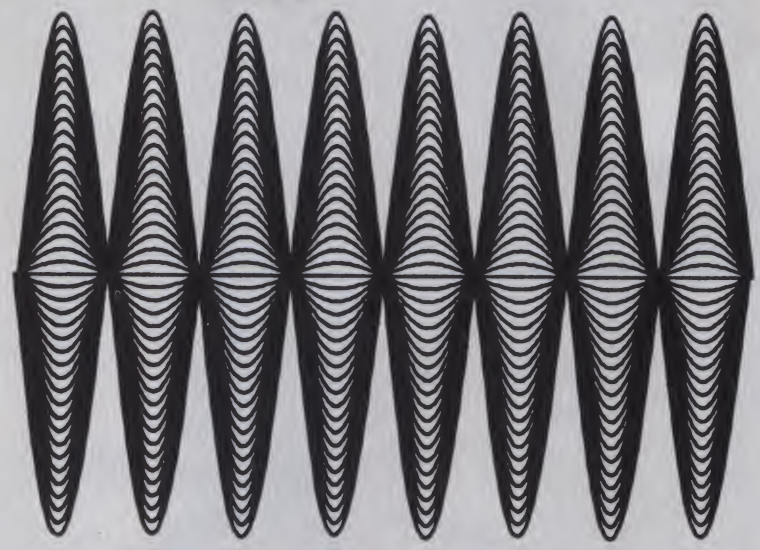
The program listings are reproduced here. However, you will not be able to make these pictures on your home computer unless you have either a mechanical plotter or high enough CRT graphics resolution to draw thin lines. As home computers evolve and improve, more and more people will acquire systems wth good graphics capability and computer art will flourish at the grass roots level. For now, I hope you like my pictures. □

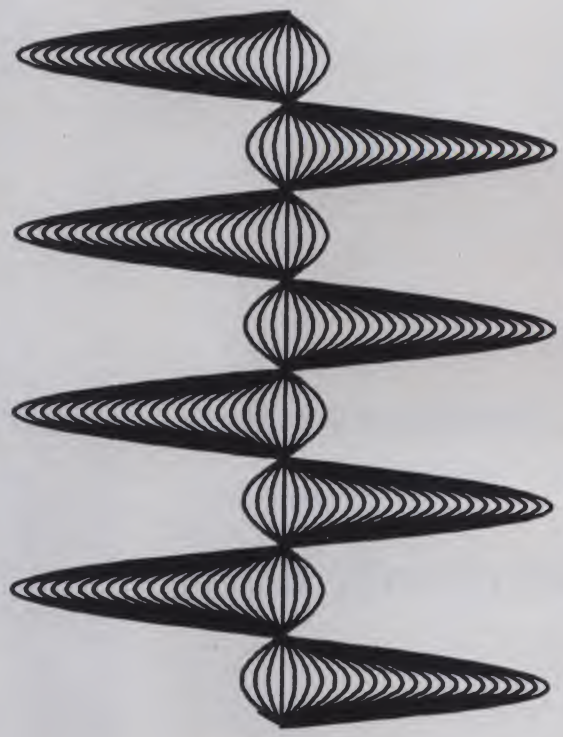
```
89 REM CURLICUE MOIRE
90 PAGE
103 B=1
105 SET DEGREES
106 PAGE
107 K=0
110 WINDOW -1000,1000,-1000,1000
111 VIEWPORT 20,110,15,85
120 FOR C=0 TO 330 STEP 30
130 FOR X=0 TO 1000 STEP 5
131 IF K=0 THEN 140
132 IF K>1 THEN 190
133 U=-X*COS(X-C)
134 GO TO 150
140 U=X*COS(X-C)
150 V=X*SIN(X-C)
155 IF X>0 THEN 160
156 MOVE U,V
157 GO TO 170
160 DRAW U,V
170 NEXT X
180 NEXT C
181 IF B=1 THEN 183
182 GO TO 190
183 K=K+1
184 GO TO 120
190 END
```



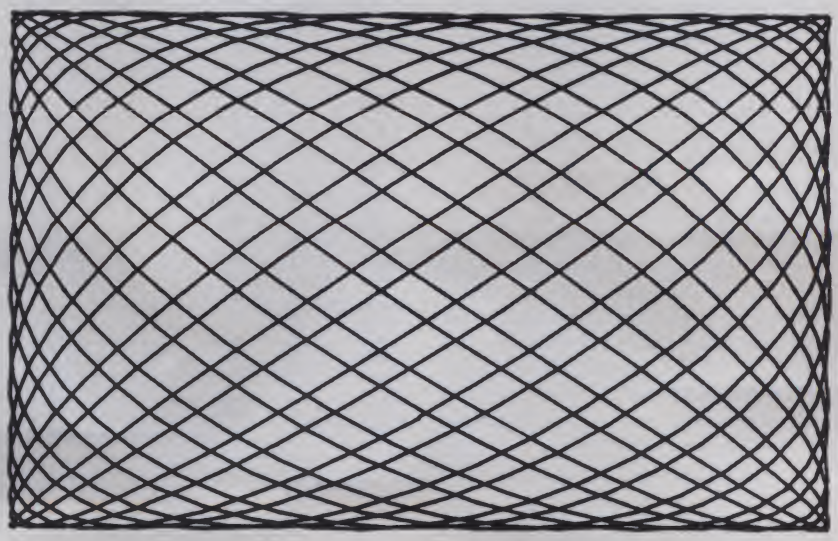
Joe Jacobson, 675 E. Street Rd., Apt. 1009, Warminster, PA 18974.

```
100 REM STANDING WAVES
101 PRINT "B IS THE INITIAL AMPLITUDE; USE B=-10 OR B=0.5"
102 PRINT "ENTER B"
103 INPUT B
105 SET DEGREES
106 WINDOW 0,1440,-10,10
107 VIEWPORT 20,110,15,85
110 PAGE
117 FOR A=B TO 10 STEP 0.5
119 MOVE 0,0
120 FOR X=0 TO 1440 STEP 5
130 Y=A*SIN(X)
140 DRAW X,Y
150 NEXT X
160 IF A=>10 THEN 170
165 NEXT A
170 END
```





```
90 REM LISSAJOUS
100 PAGE
101 PRINT "THIS PROGRAM MAKES OSCILLOSCOPE-TYPE PATTERNS. TO SEE"
102 PRINT "WHAT EACH PARAMETER REPRESENTS, REFER TO A LISTING OF THE"
103 PRINT "PROGRAM. A DECENT SAMPLE OUTPUT IS GIVEN BY:"
104 PRINT "(J,M,P1,K,N)=(20,16,0,0,0) AND"
105 PRINT "(I,G,P2,H,L)=(20,17,35,0,0) AND D=.5"
106 PRINT "TO START THE PROGRAM, HIT CARRIAGE RETURN."
107 INPUT A$
110 PAGE
120 PRINT "ENTER X PARAMETERS: J,M,P1,K,N.   ";
125 INPUT J,M,P1,K,N
126 PAGE
130 PRINT "ENTER Y PARAMETERS:I,G,P2,H,L.   ";
131 INPUT I,G,P2,H,L
134 PAGE
135 PRINT "ENTER D.   ";
136 INPUT D
140 PAGE
150 SET DEGREES
160 A=0
170 X=J*SIN(M*A+P1)+K*COS(N*A)+65
180 Y=I*SIN(G*A+P2)+H*COS(L*A)+50
190 IF A>0 THEN 220
200 MOVE X,Y
210 GO TO 230
220 DRAW X,Y
230 IF A<360 THEN 250
240 END
250 A=A+D
260 GO TO 170
```



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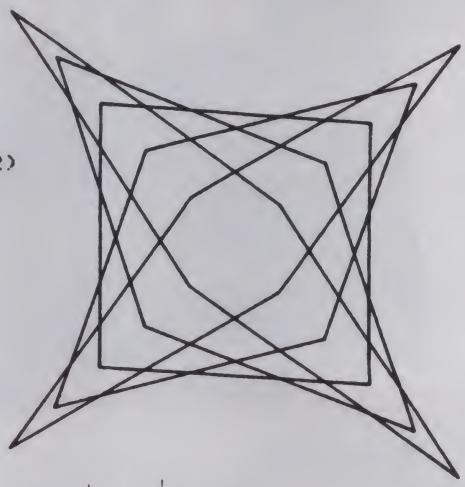
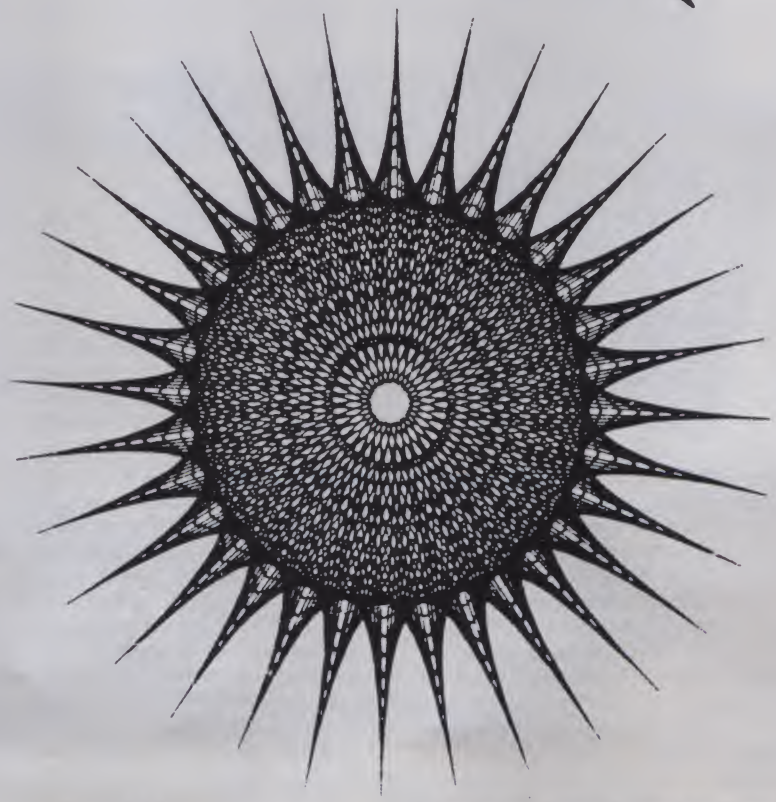
```
90 REM CONNECTED WEB
100 PAGE
101 PRINT "THIS PROGRAM,CONNECTED WEB, WAS DEVELOPED AND CODED BY"
102 PRINT "JOE JACOBSON, AND IS BASED ON A SUGGESTION BY CHRIS"
103 PRINT "KUEBLER. PARAMETER N GIVES THE # OF VERTICES. P GIVES THE"
104 PRINT "# OF IMAGINARY TIC MARKS ON EACH VERTEX AXIS. A0 IS THE"
105 PRINT "INITIAL ROTATION ANGLE. R0 IS THE OVERALL RADIUS. THE"
106 PRINT "OVERLAY ENHANCES THE PICTURE. FOR EXAMPLE, TRY:"
107 PRINT "(N,P,A0,R0)=(16,20,0,50) AND REQUEST AN OVERLAY WHEN ASKED."
108 PRINT "THIS GIVES A FAIRLY NEAT PATTERN."
109 PRINT "TO START THE PROCESS, HIT CARRIAGE RETURN."
110 INPUT A$
111 PAGE
112 SET DEGREES
113 PRINT "ENTER N,P,A0,R0."
120 INPUT N,P,A0,R0
122 PAGE
123 PRINT "ENTER 1 FOR SINGLE PATTERN, 2 FOR OVERLAY."
124 INPUT K
125 PAGE
130 D=R0/P
140 A9=360/N
145 L=1
150 I=0
160 J=0
170 A=A0+J*A9
180 R=((P-I)*(1--1↑J)+(I+1)*(1--1↑(J+1)))*(D/2)
190 X=65+R*COS(A)
200 Y=50+R*SIN(A)
210 IF J=0 THEN 240
220 DRAW X,Y
230 GO TO 250
240 MOVE X,Y
250 IF J=N THEN 280
260 J=J+1
270 GO TO 170
280 IF I=P-1 THEN 310
290 I=I+1
300 GO TO 160
310 IF K=2 THEN 322
320 END
322 IF L=1 THEN 330
323 GO TO 320
330 A0=A0+A9/2
340 L=2
350 GO TO 150
```





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The Graph Paper

Part Five: ROM Routines

David Lubar

There is a great deal of interest in the internal graphics routines found in ROM Applesoft, mostly because people believe this is one of the keys to fast animation. While these subroutines are not used in modern games, it is instructive to take a look at them and learn how they can be accessed by user programs. The majority of this article will be devoted to these routines and ways to access them.

Dedication

First, what are ROM routines? Whenever you give a command from Basic, the Apple must contain subroutines to carry out your wishes. When you type in PRINT "HELLO," the Apple calls a subroutine which contains machine language instructions that put text on the screen. These routines are found in the Applesoft ROM and in the system monitor.

Likewise, any graphics command, such as HPLOT 20,20, is carried out by a subroutine in ROM. The computer passes parameters to the subroutine. A programmer can do the same thing, thus bypassing Basic. In part, you are taking the role of a Basic interpreter. You know what you want done, and you know which routine will do it. So you skip over Basic.

This results in faster code, since the program is in machine language. But two factors prevent this method from being ideal. First, as mentioned before, the ROM routines are not super efficient. They had to be written in a limited amount of space, and thus often sacrifice speed of execution for compactness.

Also, the routines are generalized instead of being dedicated. For instance, all shapes are drawn with one set of subroutines. But if you were to write a program with just one shape in it, a dedicated routine which drew that shape at top speed would be much faster than a general shape-drawing routine. We'll see examples of dedicated routines in later articles.

While the intent of this series is not to provide a tutorial on assembly language, I want to digress slightly into that area to allow those not familiar with assembler to use the following material. If you are already familiar with assembly language, skip the next section.

Talking in Numbers

Strictly speaking, the terms "assembly language" and "machine language" have different meanings. Assembly language is written using mnemonics. These are short "words" that represent commands. The mnemonic for jumping to a subroutine is JSR, while that for returning from the subroutine is RTS. Code written on an assembler is a combination of mnemonics, addresses, numbers, and, in most cases, labels. Programs published in magazines take this form.

When the code is assembled, it becomes machine language. Machine language consists entirely of numbers. Where the programmer has written JSR $6000, the assembled code would be 20 00 60. This final product is the actual machine language program.

While it is possible, and was once fairly common, to write code in machine language, the process is tedious, error prone, hard to modify, and basically just not fun. Thus an assembler of some sort is almost mandatory. There is no reason to make life any harder than necessary, and there is no special glory to be found in hand coding.

If you have an Apple with Integer ROMs, you already have a mini assembler. It accepts mnemonics, but doesn't allow labels. In other words, it will accept JSR $6000, but won't understand JSR DRAW. There are many assemblers on the market, and the argument over which is best is approached with religious fervor. I won't proselytize, but I will mention that I am presently using Merlin at work and find it excellent for short programs.

At home, since my system doesn't have a language card, I am using TED II. Some of my co-workers use EDASSEM from the DOS toolkit while others swear by Lisa. Each assembler has strong points and weaknesses, and personal preference seems to be based mostly on which one a person first learned to use.

There are two main ways to enter the programs that will be listed in this and future articles. If you have an assembler, you can just type in the labels, operators and operands as listed. If you have no assembler, the machine code in the second, third and fourth columns (the first column shows the memory location of the code) can be entered directly into the monitor.

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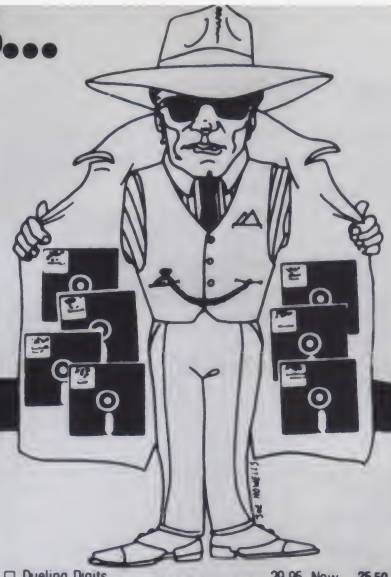

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The best way to understand exactly what is going on is to read a book on machine language. In many ways, it is simpler than Basic since there are relatively few things that can be done. Most operations involve placing a value in memory, changing a value in an arithmetic or logical manner, or controlling program flow.

The first few programs will be documented well enough so even those who are new to assembly language should be able to follow what is going on and make use of the techniques. Let's get on with it.

Taking Control

Each Applesoft graphics command can be accessed as a ROM subroutine, but there is not exactly a one-to-one correspondence when programming. For instance, when you use an Applesoft command such as DRAW 1 AT 20,20, you are actually accessing both a drawing routine and a positioning routine.

When working from assembly language, these routines will be handled separately. But the general approach to using the routines is similar to the approach used from Basic. The first step in Basic is HGR. In assembly language, you would use JSR $F3E2. This subroutine performs the initialization of page 1 of hi-res. To set up page 2, use JSR $F3D8.

Once graphics has been initialized, there are several things the programmer can do: position the hi-res cursor, plot a point, draw a line, or draw a shape. We'll take a look at the subroutines for each of these actions.

If you are interested in how the routines work, the best place to start is in the back of the Programmer's Aid manual from Apple. This contains a documented disassembly of the graphics routines from the Programmer's Aid chip. Since these routines use page three of memory for storage of most variables, the code won't be exactly the same as the Applesoft ROM, but it is close enough to help show how the routines work. (The Applesoft routines use more zero-page storage. Since commands accessing this area of memory are only two bytes long, while commands accessing any other area of memory are three bytes long, the Applesoft routines are slightly shorter.)

Most of the ROM routines make use of parameters. These parameters are passed by the accumulator and the X and Y registers of the 6502. Also, at times, parameters are held in memory. For instance, location $E7 holds the scale for drawing shapes.

Listing 1.

```
:ASM
                    1    HPOSN    EQU  $F411
                    2    *
                    3    * THE FOLLOWING THREE VARIABLES
                    4    * ARE PROGRAM VARIABLES THAT
                    5    * WOULD BE USED TO HOLD THE
                    6    * COORDINATES PASSED TO HPOSN
                    7    *
                    8    VERT     EQU  $FD    ;ANY FREE LOCATION
                    9    HORLO    EQU  $FE    ;WILL DO
                    10   HORHI    EQU  $FF
                    11   *
                    12   * PUT VERTICAL POSITION IN
                    13   * THE ACCUMULATOR
                    14   *
7000: A5 FD         15            LDA  VERT
                    16   *
                    17   * PUT LO BYTE OF HORIZONTAL IN X
                    18   * AND HI BYTE IN Y
                    19   *
7002: A6 FE         20            LDX  HORLO
7004: A4 FF         21            LDY  HORHI
                    22   *
                    23   * CALL THE ROM SUBROUTINE
                    24   *
7006: 20 11 F4      25            JSR  HPOSN

--- END ASSEMBLY ---

TOTAL ERRORS: 0

9 BYTES GENERATED THIS ASSEMBLY
```

First, we'll look at HPOSN, the routine that sets the hi-res cursor. As mentioned in an earlier article, the hi-res cursor determines where on the screen a point will be plotted or a shape drawn.

As you might have guessed, HPOSN requires two parameters, a horizontal value and a vertical value. These could be referred to as X and Y locations, but that would cause confusion with X and Y registers (the two have nothing in common), so the terms "horizontal" and "vertical" will be used. The vertical location, as in Basic, ranges from 0 to 191.

Horizontal values go from 0 to 279. Since the 6502 registers are only eight bits, with a maximum value of 255, the horizontal value cannot be contained in one register. Instead, the lo byte is placed in the X register and the hi byte is placed in the Y register. The vertical value is placed in the accumulator. Sample code for positioning the hi-res cursor can be found in Listing 1.

HPOSN is not very exciting since it doesn't put anything on the screen. This can be done with the HPLOT subroutine. It is set up just as HPOSN, but also requires a color. This is where things get interesting. Location $E4 holds the color value. But this value isn't in the range of 1 through 7 as it would be in Applesoft. Instead, it is a byte mask which handles the oddities of Apple colors. But the programmer doesn't have to worry about it.

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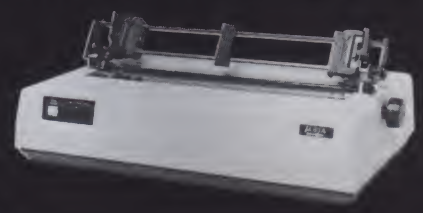

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Graph Paper, continued...

Obviously, Applesoft requires a routine to change the Basic HCOLOR value to the proper color mask. This routine is also in ROM. Just place the desired color number in the X register and JSR $F6F0.

Once you are able to plot a point, you can do all sorts of things, just as we did with the Applesoft HPLOT command. Data stored in tables can be used to draw figures or plot functions. And, just as the HPLOT routine in Applesoft can also be used to draw lines, there is a monitor routine to do this task.

To draw a line, first set the starting point with the HPLOT or HPOSN subroutine, as described above. Next, the other endpoint must be defined. For some reason, while it requires the same parameters, they are passed in a different fashion. The vertical coordinate goes into the Y register. The lo byte of the horizontal coordinate goes into the X register and the accumulator gets the lo byte. The routine is located at $F53A.

The DRAW and XDRAW subroutines are next on the list. Before drawing anything, the hi-res cursor must be positioned. This is done with HPOSN. Also, color and scale must be defined. Scale is determined by the value in location $E7. As in Applesoft, scale increases from 1 to 255, and a value of 0 gives the largest possible scale. Rather than use an index into the shape table, each shape can be referenced by its actual location, which allows one, if he wants, to scatter shapes through memory. The Y register contains the hi byte of the shape location while the X register holds the lo byte. The accumulator contains the rotation. The address of DRAW is $F601, and XDRAW is at $F65D.

As an example of how to use these subroutines, Listing 2 contains a program that draws spirals on the screen. It uses a small shape consisting of a single dot, and draws larger lines by changing the scale. The routine takes advantage of the fact that when a shape is drawn, the hi-res cursor ends up wherever the last command in the table left off. In this case, where the table just contains a command to plot and then move, the cursor will always be found at the end of the line.

Animation using the ROM routines is done in the same fashion as animation from Applesoft. A shape is drawn, then it goes through a sequence of erases and draws. Page flipping can be used, with the value in location $E6 determining which page is accessed. A value of $20 is used for page 1, while a value of $40 puts you in touch with page 2.

A Bit of Philosophy

This month's prize-winning question (the prize is a copy of *Shape Master*) comes from Mike Cameron who writes,

Listing 2.

```
:ASM
                    1            ORG  $1000
                    2   HGR      EQU  $F3E2
                    3   HPOSN    EQU  $F411
                    4   DRAW     EQU  $F601
                    5   HCOLOR   EQU  $F6F0
                    6   SCALE    EQU  $E7
                    7   FULLSCRN EQU  $C052
                    8   *
                    9   * FOLLOWING VARIABLES ARE
                   10   * PROGRAM VARIABLES AND NOT
                   11   * PART OF THE ROM ROUTINES
                   12   *
                   13   COLOR    EQU  $FE
                   14   ROT      EQU  $FF
                   15   TABLE    EQU  $300
                   16   *
1000: 20 E2 F3     17            JSR  HGR     ;INITIALIZE GRAPHICS
1003: BD 52 C0     18            STA  FULLSCRN ;SET FULL SCREEN MODE
                   19   *
                   20   *SET UP SMALL SHAPE DEFINITION
                   21   *
1006: A9 04        22            LDA  #$04    ;VECTOR FOR PLOT AND
1008: 8D 00 03     23            STA  TABLE   ;MOVE UP.
100B: A9 00        24            LDA  #$0     ;MARK END OF SHAPE
100D: 8D 01 03     25            STA  TABLE+1
                   26   *
                   27   *STORE COLOR VARIABLE
                   28   *
1010: A9 03        29            LDA  #$03    ;WHITE 1
1012: 85 FE        30            STA  COLOR
                   31   *
                   32   *GIVE INITIAL POSITION
                   33   *AT CENTER SCREEN
                   34   *
1014: A0 00        35   LOOP1    LDY  #$0     ;HORIZONTAL HI BYTE
1016: A2 8C        36            LDX  #$8C    ;HORIZONTAL LO BYTE
1018: A9 60        37            LDA  #$60    ;VERTICAL COORDINATE
101A: 20 11 F4     38            JSR  HPOSN   ;SET HI-RES CURSOR
                   39   *
                   40   *SET COLOR
                   41   *
101D: A6 FE        42            LDX  COLOR
101F: 20 F0 F6     43            JSR  HCOLOR
                   44   *
                   45   *SET INITIAL SCALE
                   46   *
1022: A9 01        47            LDA  #$01    ;SMALLEST SCALE
1024: 85 E7        48            STA  SCALE
                   49   *
                   50   *AND INITIAL ROTATION
                   51   *
1026: A9 00        52            LDA  #$0     ;ROT=0 DEGREES
1028: 85 FF        53            STA  ROT
                   54   *
                   55   *MAIN LOOP
                   56   *
102A: A2 00        57   DRAWLOOP LDX  #$0     ;LO BYTE OF SHAPE ADDRESS
102C: A0 03        58            LDY  #$03    ;HI BYTE OF SHAPE ADDRESS
102E: A5 FF        59            LDA  ROT
1030: 20 01 F6     60            JSR  DRAW
1033: A5 FF        61            LDA  ROT
1035: 18           62            CLC
1036: 69 10        63            ADC  #$10    ;PRODUCES A ROTATION
1038: 85 FF        64            STA  ROT     ;OF 90 DEGREES
103A: E6 E7        65            INC  SCALE   ;INCREASE SIZE OF SHAPE
103C: E6 E7        66            INC  SCALE
103E: A5 E7        67            LDA  SCALE
1040: C9 BD        68            CMP  #$BD    ;TOO LARGE?
1042: D0 E6        69            BNE  DRAWLOOP ;NO
                   70   *SPIRAL IS NOW DRAWN. TIME TO
                   71   *CHANGE COLOR (ALTERNATING
                   72   *BETWEEN BLACK AND WHITE) AND
                   73   *DO IT ALL AGAIN.
1044: A5 FE        74            LDA  COLOR
1046: 49 03        75            EOR  #$03
1048: 85 FE        76            STA  COLOR
                   77   *
                   78   *CHECK FOR KEYPRESS
                   79   *
104A: AD 00 C0     80            LDA  $C000
104D: 10 C5        81            BPL  LOOP1
104F: 2C 10 C0     82            BIT  $C010
1052: 60           83            RTS

--- END ASSEMBLY ---

TOTAL ERRORS: 0

83 BYTES GENERATED THIS ASSEMBLY
```

"What type of routines should a person use in machine language?" He goes on to say that he has seen the points for Applesoft ROM routines, but believes there must be better routines around, such as those found in some assemblers.

Before directly answering the question, I would like to point out what I feel is the main reason for not using the ROM routines. If you are writing a program that accesses the ROM routines, you have already committed yourself to a fair amount of assembly language coding. Having gone this far, it isn't much of a leap to reach the point where you don't need the ROM routines. When you use ROM subroutines, you are restricting yourself to generalized code with rigid requirements and format.

There are only two viable options: either use one of the specialized graphics packages on the market or write your own code. The choice depends on the application. There are some good animation packages on the market that provide subroutines for many applications. But if you plan to have a really large number of objects moving at high speed, you may need specialized code.

For instance, if you wanted to move twenty occurrences each of three shapes, it would be better to write three routines —one to draw each shape at maximum speed—than to use a general shape-drawing routine. Also, writing your own code is the best way to get a feel for graphics and to really understand what is going on.

In general, the best routine is whatever routine accomplishes the job without taking too much time or placing too many restrictions on the programmer. The ROM routines fail to meet these criteria for most applications.

In future articles, we'll be developing specialized routines for drawing shapes and performing other graphics functions. These will serve as building blocks or starting points, allowing you to develop the right routine for each job.

Other Stuff

Thanks to Dan Lazarowski who wrote a note concerning the circle-drawing program from August. He mentions that the FOR...NEXT loops can be calibrated by adding

```
50 S=ATN(1/RA)
60 FOR I=O to 6.30 STEP S
```

He points out that this produces "the smoothest circle possible without overdoing precision and thus slowing down the program." All in all, a nice touch and a good example of expanding on a program.

Next month we'll cover assembly language routines that access and manipulate the hi-res screen, and take a look at character graphics. See you then. □

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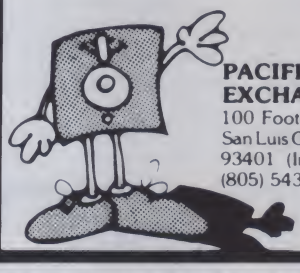

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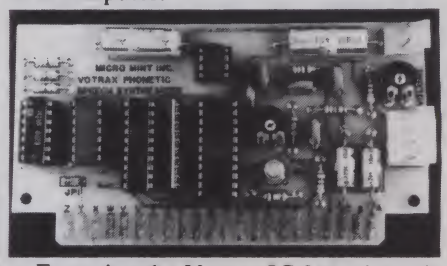

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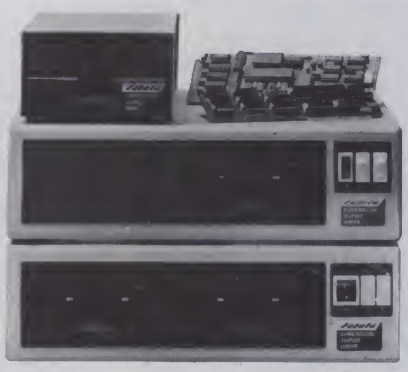

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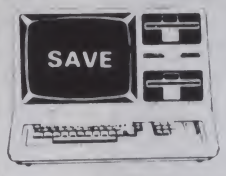

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New Products, continued...

PERIPHERAL FOR H-89/Z-89

Artra Inc. announces Housemaster—an add-on printed circuit card for the H-89. The standard Housemaster board provides the H-89 with four separate peripherals on a single printed circuit card. These include voice recognition, stereo sound synthesizer, a real-time clock/calendar, and a BSR X-10 home control interface. Available options are a battery backup for the clock, two types of voice synthesis and two RS-232 serial ports. All options mount on the same board.

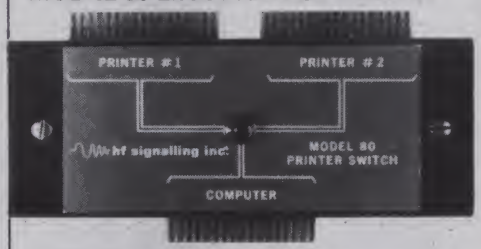
The price of the Housemaster board is $399 for the kit and $479 for the assembled, calibrated and tested version.

Artra Inc., PO Box 653, Arlington, VA 22216. (703) 527-0455.

CIRCLE 363 ON READER SERVICE CARD

MISCELLANEOUS

MODEL 80 LINE PRINTER SWITCH



HF Signalling Inc. announces the Model 80 Line Printer Switch. Designed specifically for TRS-80 Model I and III computers, it allows the user to have two separate line printers on line at all times.

The Model 80 Line Printer Switch connects to the printer port of the computer and provides an edge connector for each of two printers.

HF Signalling Inc., P.O. Box 17510, Kansas City, MO 64130. (816) 931-4448.

CIRCLE 364 ON READER SERVICE CARD

APPLE II SLOT SWAPPERS

Johnson Associates has developed Slot Swappers, a hardware device for the Apple II, which remedies problems caused by slot dependent software and hardware. Slot Swappers interchanges two slots with the flip of a switch to avoid hardware damage and eliminate card manipulation. $79.95.

Johnson Associates, Box 1870, Phoenix, AZ 85001. (602) 979-4554.

CIRCLE 365 ON READER SERVICE CARD

APPLE SYSTEM SAVER

System Saver for the Apple II protects programs and data by smoothing out power surges and spikes, and provides aerodynamically correct cooling by drawing air across the mother board, over power supply, and out the left-hand ventilation slots.

A power switch with pilot light allows user to power fan, surge suppression, computer, and 1 of 2 auxiliary outlets from one switch. $89.95.

Kensington Microware Ltd., 300 East 54th St., Suite 3L, New York, NY 10022. (212) 490-7691.

CIRCLE 366 ON READER SERVICE CARD

SYSTEMS SOFTWARE

SYSTEMS

Metatext is a text editor that comes on a single master disk and offers many Apple II system options. Features of the package include: full ASCII 80-column alphanumerics, 40-column option, creation routines, a text formatter, and various line-oriented text editors. The package includes a serial output program which will drive most RS232 printers from the existing game I/O connector. $79. Metaresearch, Inc., 1100 SE Woodward St., Portland, OR 97202. (503) 232-1712.

CIRCLE 367 ON READER SERVICE CARD

Extended S-C Applesoft Program Editor is a programmer's tool to speed up and simplify the development of Applesoft Basic programs. ES-CAPE provides a split-screen editing window, global search and replace, DOS command menu, list control, and more. $40. S-C Software Corporation, 2331 Gus Thomasson, Suite 125, Dallas, TX 75228. (214) 324-2050.

CIRCLE 368 ON READER SERVICE CARD

Dosplus II is a TRSDOS compatible alternative operating system for the TRS-80 Model II Microcomputer. A full line of support software is included including a terminal/host package and full disk editing/repair programs. The system uses Microsoft Basic. Also a standard floppy disk version for the Model II hard disk subsystems including Radio Shack, VR Data, Corvus, Micro-Mainframe, and QuCeS is available. $249.95. Micro-Systems Software Inc., 4301-18 Oak Circle, Boca Raton, FL 33431. (305) 983-3390. PowerSoft, 11500 Stemmons Fwy., Suite 125, Dallas, TX 75229. (214) 484-2976.

CIRCLE 369 ON READER SERVICE CARD

LANGUAGES

The **UCSD p-System** operating system is available for the Osborne 1 personal business computer. This machine-independent operating system for 8-bit and 16-bit microprocessors operates on

the Apple, Tandy, Commodore, Texas Instruments, Xerox and IBM. The p-System allows programmers to work with any combination of UCSD Pascal, Fortran-77, Basic, and assembly language. Osborne Computer Corporation, Corporate Headquarters, 26500 Corporate Ave., Hayward, CA 94545. (415) 887-8080.

CIRCLE 370 ON READER SERVICE CARD

Peachtree Graphics Language is an interactive graphics programming language for CP/M based computers. Included with the Business Graphics System is an interface to Peachtree's PeachCalc Electronic Spreadsheet and PeachText Word Processor. IBM Personal Computer and CP/M 86 versions of PGL are also available. Peachtree Software Incorporated, 3445 Peachtree Rd., N.E., Atlanta, GA 30326. (404) 239-3000.

CIRCLE 371 ON READER SERVICE CARD

DATABASE MANAGEMENT

DataKEYper is a data management package for three and four floppy disk drive configurations. It runs on the Apple II Plus and a Corvus hard disk drive. A version is also available for a two floppy (5 1/4" or 8") disk configuration. DataKEYper is menu driven and handles up to 800 files. Some capabilities included are data file sort, file maintenance, file query, and report writer. $249.95. ESP Computer Resources Inc., 9 Ash St., Hollis, NH 03049. (603) 465-7264.

CIRCLE 372 ON READER SERVICE CARD

Data-Writer is a database manager for the TRS-80 Models I and III that can be used with a word processor or by itself as a stand-alone system for managing textual and numeric data. Ten programs provide functions for managing and using databases, including the ability to change their structures. $125. Software Options, Inc., 19 Rector St., New York, NY 10006. (212) 785-8285.

CIRCLE 373 ON READER SERVICE CARD

Disk Listmaker is an upgraded version of a 16K tape database for holding names or items plus five-digit codes. The disk version is available in 48K, with a capacity of 1000 names, and 32K with a 500-name capacity for TRS-80 Models I and III. $20. Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365. (213) 704-8495.

CIRCLE 374 ON READER SERVICE CARD

The **Rose** Management Information Group is database software for business or home use. Rose can be used to create a database for a customer list, or to generate reminder lists. It is designed to operate on Apple III computers. $349.95. The Denver Software Company, 14100 East Jewell Ave., Suite 15, Aurora, CO 80012. (303) 750-9980.

CIRCLE 375 ON READER SERVICE CARD

A disk based **Data Manager System** for the VIC-20 Computer is a comprehensive system that allows the user to define and manage his own database and record entries on disk. It can also create, add, delete, and change records, as well as browse through, search, print, and exit the file. It stores up to 1200 records on a single disk. In addition to the VIC-20 application, the system is also offered for any Commodore CBM or PET, Commodore 64, Atari 800, Apple II, and IBM Personal Computer. $59.95. MicroSpec, Ltd., 2905 Ports O'Call Court, Plano, TX 75075. (214) 867-1333.

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File is a general purpose cassette-based file system that allows the user to construct, sort, maintain and print out a wide range of data types, such as mailing lists, accounts and book lists. The system requires an 8K PET/CBM or Vic-20 with 3K expansion cartridge. It expands automatically to all available memory. The package includes software on cassette and complete documentation. $9.95. Kinetic Designs, 401 Monument Rd. #171, Jacksonville, FL 32211.

CIRCLE 377 ON READER SERVICE CARD

The **RL-1 Relational Database Management System** is for the IBM personal computer and CP/M based systems. The RL-1 database is fully relational and includes such operators as selection, projection, and join. It also features query language, and relational editor and program interface. Other application packages are available also. $495. ABW Corporation, P.O. Box M1047, Ann Arbor, MI 48106. (313) 971-9364.

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AND NOW OS/A+ (for standard Atari or Apple drives) is included as a part of **every** standard OSS language package. Versions of OS/A+ for some higher capacity drives available at extra cost.

Unless otherwise noted, all OSS products require 48K and at least one disk drive. We recommend 64K for the Apple version of OS/A+.

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The **first** and still **finest** speed reading tutor designed for **you** to use on **your** computer is available **only** from OSS.

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NOTE This Atari [illegible] requires [illegible] of RAM.

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NOTE [illegible]

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***REMEMBER** Standard OS/A+ is **included** at no extra charge with BASIC A+, MAC 65, C 65, and tiny c.

[illegible] *SpeedRead* [illegible]

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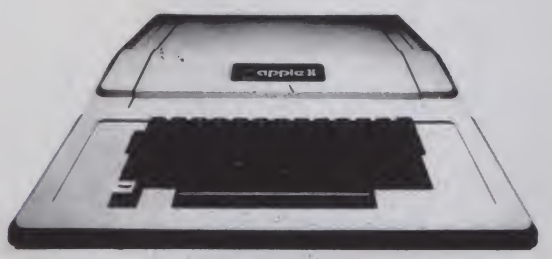

le cart...apple cart...apple c

Chuck Carpenter, who is on vacation this month, sent us the following note concerning the 2716 adapter and other items he wrote about for the August Apple Cart. Chuck will be returning next month with a new Apple Cart column.

On page 224 (top of 3rd column) there should be a plus sign (+) between the two CHR$ statements. On page 226, under the diagram, the first line should say "bend-up pins 18 and 21." Also on the same page, Ragnar's last name is Fyri.

The adapter I showed will work, but the information is incomplete. A speedy response from Ray Ransom provided the improved adapter circuit shown in Figure 1. As Ray points out in his letter, the adapter I showed will only work in machines with Integer Basic on the main circuit board and no language cards (slot 0), or memory board in any slot. That's because my adapter doesn't provide for the INH bar (INH NOT, active low) signal at pin 18. As far as I can determine, only the language and memory cards use this signal. Use of my adapter with peripheral cards may not cause a problem (I used it with my printer driver program until the programmers aid ROM came along in the $D000 slot). Check your schematic for the use of the INH signal at pin 18 of the ROM socket and pin 32 of the 50-pin expansion connectors.

Also, according to Ray, 2716s will work in an Integer Basic firmware card *only* if they are the 350 ns. variety, which are very rare. Furthermore, the programs contained in the EPROMs are available only when the card is enabled. My thanks to Ray for his timely comments and criticism.

Jack Trainor, 118 Norfolk St., Cambridge, MA 02139.

Jack Trainor

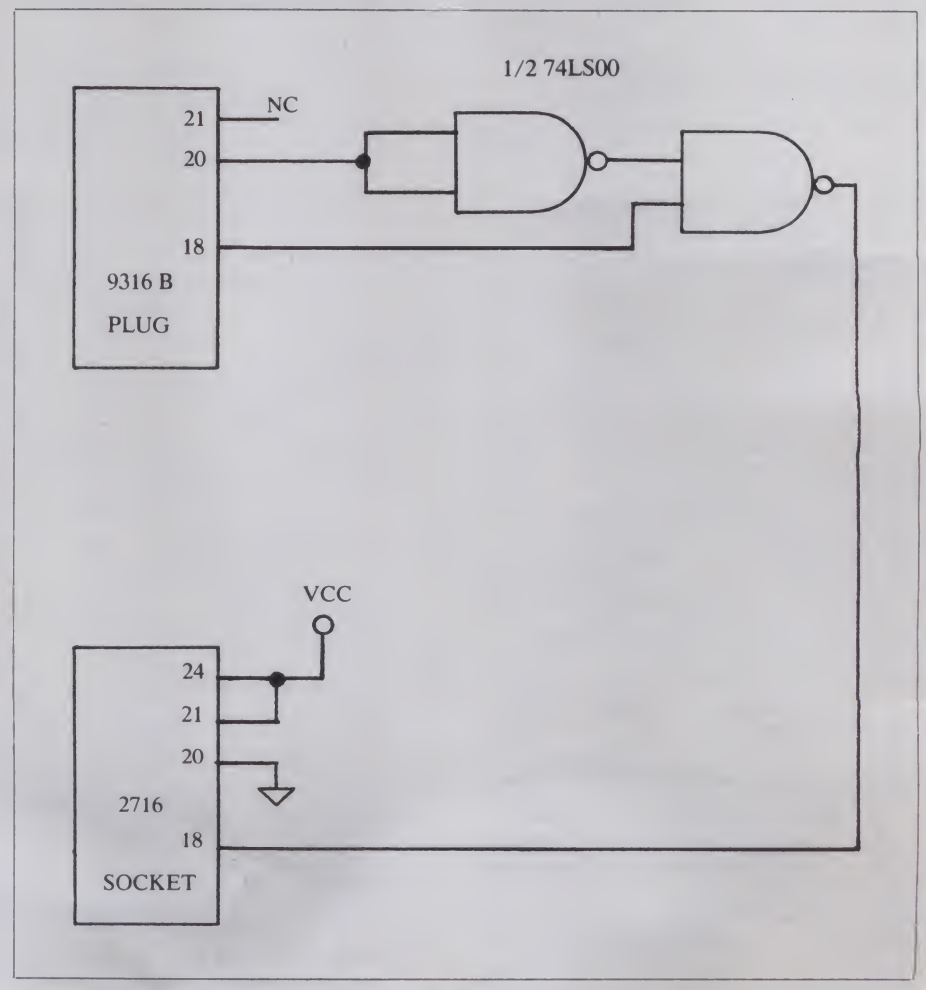

Figure 1. 2716 to 9316B adapter by Ray Ransom. All pins not shown are connected together. Be sure to provide appropriate voltages to the LS00.

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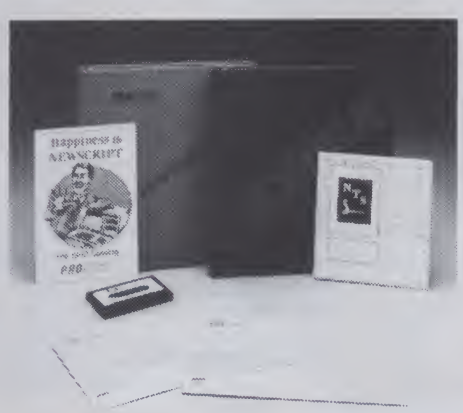

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The Epson MX-80 and its big brother, the MX-100, have become the dominant printers for microcomputers and understandably so. It is a success story that parallels that of the Japanese cars—better than average features and performance coupled with incredible reliability.

The Epson delivers a handsome dot matrix typeface, is simple to operate, and just won't quit. In the past year Epson has come out with a graphics option, called Graftrax, that allows the MX printers to print hi-res graphics—a perfect complement to the Apple II. Not surprisingly several peripheral cards and software packages have emerged for the Apple-Epson combination.

I am the happy owner of an MX-80 and in this month's column I will review some of these new products, especially those that make use of the Graftrax.

Printer Interfacing

But first, I should provide a little background on printer interfacing, one of my favorite neglected topics in the microcomputer world.

At first glance interfacing a printer to a microcomputer looks easy. The power cord goes into an AC outlet; the printer cable goes into the computer—just a little more complicated than setting up a toaster. Would that it were so simple. Instead, you often find an unholy tangle of software, hardware, and firmware, and heaven help you if you don't have good dealer support when your printer and computer don't seem to be talking to each other. Neither the printer companies nor the computer companies are effectively addressing the issue of interfacing at present.

You may interface a printer to a computer in one of two ways: serial or parallel mode. Both modes have their standards—RS-232 for serial, Centronics-compatible for parallel. Both standards have enough leeway for sneaky incompatibilities, but this is more true for the RS-232 serial interface. In general my advice is to choose parallel rather than serial, since parallel transmits data faster, and is easier to interface. However, with parallel your cable length is limited to ten feet, and some printers do not have the circuitry for parallel interfacing.

The Epson MX-80 does contain a built-in Centronics parallel interface, so all the interface cards I will be writing about now are parallel cards. I will save serial interfacing—a much messier topic—for another time. (Except for the width of the carriage there is little difference between the MX-80 and MX-100. What I write will apply to the MX-100 as well.)

The MX-80 works perfectly well when interfaced to most parallel cards for the Apple II. The only exception to this is that some parallel cards, such as the CCS 7728, are not directly compatible with CP/M or Pascal, the other two operating systems for the Apple. I always check a printer interface card for compatibility outside of Apple DOS.

Epson markets its own parallel card (#8131) for the Apple II, and for a plain vanilla parallel card, it is a good buy. It has no firmware for a graphics dump or onboard memory for buffering, but it does its job dependably and unobtrusively for only $90. I have also seen a card by Microtek, the API-2, that works equally well for about the same price.

Printing Graphics

So far we have the Apple with a parallel card (in slot #1, of course) connected to an Epson MX-80 with Graftrax. But can you print graphics yet? Not quite. If you check your manual, you will find that the bit image graphics (as well as the other Epson features) are controlled by escape codes. To print an image from either of the Apple hi-res screens, the proper sequence of escape codes must be calculated then sent to the printer.

In other words, there must be a program that will translate the binary code, which represents an image in Apple memory to different binary code that will instruct the printer to print that image. Such a program performs what is known as a "graphics dump"—it dumps a graphic image to the printer.

To get a graphics dump, you could write the program yourself. It is a routine sort of program, not difficult, just tedious. Or you could take advantage of the programs commercially available. These come in two flavors: software and firmware.

Software you are already familiar with—it is just a package in which the program comes on a floppy disk that you boot and then follow directions.

Firmware, as the name suggests, is a cross between hardware and software. The machine code for the graphics dump is burnt into an IC chip, a ROM or a PROM, and mounted on the printer interface card. The program is activated to print graphics by sending the card a CONTROL-I followed by a string of code characters.

The end result, the printed graphics, depends on how the program is written, not on the form in which it exists. Practically speaking, though, there are some tradeoffs.

Software is usually more elaborate and has more features, such as cropping of printed pictures. It is easier to operate; the user has friendly menus for selecting the way the picture will be printed. So far, available software will run under only one operating system, Apple DOS.

Using firmware, most of the cards can print graphics from all three operating systems for the Apple: DOS, Pascal, and CP/M. They allow graphics to be printed from within the user's program (in any of three operating systems). But, they must communicate with the card in a not-so-obvious shorthand code, for example, ^IGRDE2, to control printout.

In terms of cost, the price of a regular parallel card plus the graphics dump software program is roughly the same as the price of a graphics dump printer card, though the price on the graphics cards will probably drop. If you already own a regular parallel card it will, of course, be cheaper just to buy the software.

The following are good products that do what they are supposed to do with little, if any, fuss. The documentation ranges from adequate to excellent. In comparing them I think you should first consider the size of the graphics dump you want. Some of the products print only two sizes and may miss the size you want. Next consider the special features. Finally, check to see the product is compatible with CP/M or Pascal if you intend to use one of these operating systems.

Software Graphics Packages

I will start with the software packages: *Image Printer*, *Zoom Grafix*, *Graphtrix*, and *Enhanced Graphic Software*. All four will print either graphics screen in varying sizes and are good buys.

Some allow you to crop the image you are printing. That is, you can select any rectangular section of the graphics screen and the printer will print only that portion. So, if you had an image of a face on your Apple screen, you could print a picture of just the eyes, using the cropping technique.

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Table of software features.

	Sensible Software Image Printer	Phoenix Software Zoom Grafix	Data Transforms Graphtrix	Computer Station Combined Enhanced Graphics Software
Sizes (inches) of Full Screen Printout	3.2 x 3.9 6.4 x 7.8 6.4 x 11.7	2.3 x 2.7 2.7 x 4.7 2.3 x 5.4 4.7 x 5.4 5.4 x 7.0 6.4 x 7.8 6.4 x 11.7	1.7 x 2.4 2.7 x 4.7 5.4 x 7.0	2.7 x 4.7 5.4 x 7.0
Rotate Image	No	No	No	No
Print in Emphasized Mode	No	Only emphasized	Only emphasized	Small-No Large-Yes
Compatible with CP/M and Pascal	No	No	No	No
Compatible with Other Printers	NEC 8023	Anadex 9000, 9001 9500, 9501 Diablo Epson MX-70, 80, 100 IDS 440, 445, 460, 560 MBI 88G NEC 8023 ProWriter Qume Silentype Spinwriter Starwriter Xerox	Anadex 9000, 9001 9500, 9501 IDS 440, 445, 460, 560 Centronics 739 MPI 88G Silentype	Anadex 9500, 9501 Centronics 739 Diablo Datasouth IDS 440-560 NEC PC 8023 NEC Spinwriter Qume
How?	Separate Package	On Disk	On Disk	On Disk
Compatible Interface Cards	Apple Centronics CCS 7720A 7720B 7728 Epson APL Mountain Computer CPS Orange Micro-Grappler	Apple: Centronics, parallel serial and communication CCS: 7710, 7720, 7728 Epson: APL Mountain Computer: CPS Interactive Structures: EP-12 (Pkaso) SSM-AIO: Parallel and serial Tymac parallel	Only parallel cards Apple: Parallel and Centronics CCS 7728 Epson: APL Mountain: CPS Tymac Parallel SSM-AIO	Apple: Parallel and Centronics Super Serial CCS: 7710A, 7720 7728 Mountain: CPS (Parallel) Computer Station: Station Master
Cropping How?	Yes Easy Cursor Controls	Yes Specify coordinates	Yes-Only horizontal Specify coordinates	No

All these programs assume that you are within Apple DOS. Basically, any image you can capture in an Apple DOS binary file can be printed with these programs. This is not as great a limitation as it might seem.

The picture I used to test these different products was the image of a chess position taken from the *Sargon II* chess program. I reset the Apple when I had reached to position I wanted to print, then booted a system master disk. This left the graphics screen intact.

From there I just used the BSAVE command to save the screen to disk. (BSAVE NAMEOF.PIC, A$2000, L$2000 for *hi-res* screen 1; BSAVE NAMEOF.PIC A$4000, L$2000 for screen 2.) With a bit of hacking, which is fun and educational, you can save pictures from many programs with graphics, and then print them out on your Epson.

Image Printer by Sensible Software

Let's start with my favorite of the group. What makes this program such a winner is ease of use. Sensible Software is quite sensible when it comes to making things easy for the user. I was able to breeze through this program on the menus alone.

Best of all, cropping an image from the hi-res screen is a snap. You just move a pair of crosshairs around the screen using the I-J-K-M diamond to mark two opposite corners of the rectangle you want. The other programs require that you specify the x and y coordinates of the area you want, which is several times more tedious.

Zoom Grafix by Phoenix Software

Although not as easy to use as *Image Printer*, *Zoom Grafix* is the most flexible of all the packages. You can directly control the ratio of horizontal dots to vertical dots. Thus you can print graphics in more different sizes than any of the other products reviewed here (though some of the sizes will be distorted like the image in a fun house mirror).

You really can "zoom" in a small portion of the graphics screen and blow it up on your printer—a very fine effort from Phoenix Software.

Graphtrix by Data Transforms

Graphtrix does not have the fancy cropping of *Zoom Grafix* and *Image Printer*—in fact, you can crop only horizontally off the top or bottom—but it does have a few tricks of its own.

With *Graphtrix* you can print the smallest version of the graphics screen: about one inch square. At this size the dots tend to blend together, and that "blocky" look that occurs in the higher magnifications

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Table of interface card features.

	Practical Peripherals Microbuffer II	Computer Station Station Master	Genie Computer Corp. Genie Card	Interactive Structures Pkaso
Sizes (inches)	2.6 x 4.8 6.5 x 7.8	2.6 x 4.8 5.4 x 7.0	2.6 x 4.8 6.5 x 7.8	2.6 x 4.8 3.7 x 3.2 6.5 x 7.8 w/MX-100 also 2.7 x 4.7 5.3 x 9.3
Rotate Image by 90°	Yes	No	Yes	Yes
Print in Emphasized Mode	Yes	Small image-no Large image-yes	Yes	Yes
Compatible with CP/M and Pascal	Yes	Needs patch to work with CP/M	Yes	Yes
Compatible with Other Printers	IDS NEC Okidata	NEC 8023 Centronics 739 Anadex 950	NEC C.Itoh Anadex IDS	Okidata IDS Centronics
How?	Different ROMs	DIP switches on card	Different ROMs	Different ROMs
Cost	w/16K RAM $260 w/32K RAM $300	$175	$135 w/o Graphics $159 w/ Graphics	$165
Comments	On-board RAM allows buffering of text or graphics so Apple can be used while printer prints.		Also has several commands for formatting text. Will do a text screen dump	Most sophisticated range of features • Lo-res and halftone graphics • User defined special characters • Super-res (2160 x 960) dots per page

is eliminated. Placed in an upper corner, such a picture could be used to create fine personalized stationary.

In fact, *Graphtrix* images are meant to be juxtaposed with text. *Graphtrix* is designed to dovetail with *Applewriter* so that you can combine text and graphics on the same page. *Graphtrix* will also handle footnotes. The *Graphtrix* manual is printed on an Epson, using *Applewriter* and *Graphtrix*.

So *Graphtrix* is the package to get if you want to embed printed graphics in text. As a screen dump it is fine too. Data Transforms generously allows you to include the screen dump as a subroutine in your own Applesoft programs.

Combined Enhanced Graphics Software

Computer Station produced one of the first (if not *the* first) printer graphics programs for the Apple. Initially they had separate packages for different printers. Now they have bundled all these separate programs together (and added a few more for the newer printers) into one package. *Enhanced Graphics Software* (EGS) is your basic screen dump in two sizes, normal (4" x 3") and expanded (7" x 5"). It is a solid product—good menus, easy to operate.

As with *Graphtrix*, Computer Station has provided instructions so that you can use the graphics printout as a subroutine in a Basic program.

My one criticism is that the documentation comes on several sheets of looseleaf paper and presumes that you will buy one of the notebooks that Computer Station sells to contain them.

Interface Cards With Special Firmware

Now we move to consider several printer interface cards: the Microbuffer II, the Genie Intelligent Printer Interface, Station Master, and Pkaso. The first three cards are very similar—they provide two sizes of graphics dump and are controlled by almost identical codes. The Pkaso board has many more options and very different control codes. Except for the Station Master all these boards work with CP/M and Pascal, as well as Apple DOS.

Station Master by Computer Station

The graphics dump from this card is the same as the one you get from Computer Station's *Enhanced Graphics* program described above. The control codes for a Station Master graphics dump begin with CONTROL-IG, followed by optional modifiers. The codes for the Microbuffer and the Genie board are about the same.

The large size dump is 5.4" x 7.0" which I think looks better than the 6.5" x 7.8" large dump produced by the other boards. A slight glitch: the large dump is printed in emphasized mode (darker) and the normal size dump is in normal mode. (This is also true of the *EGS* program.)

The Station Master will print text and graphics from CP/M but requires a patch to the CP/M BIOS to do so. For printing graphics from Pascal, Computer Station has thoughtfully included in their documentation the code for a working program that can be easily adapted as a procedure in the user's own programs.

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Singing Apples? — Apple owners get all these capabilities too — as a plug-in card plus diskette. Or there's a deluxe version with the dictionary in ROM (no diskettes to bother with), speaker, and ability to "sing" (hey we're not making this up folks) in any key. (Both Apple versions require 32K or more. Applesoft and DOS 3.3).

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Genie Intelligent Printer Interface by Genie Computer Corp.

The Genie card includes a rotate command that will rotate an image 90 degrees clockwise. This is necessary when printing the large size graphics dump. In addition to the graphics dump, the Genie card includes a text screen dump and several text formatting commands. You can set your margins, line length, and page length with CONTROL-I commands.

This card works so well with all three operating systems that you hardly notice it, which is exactly the way it should be with interface cards. The Genie card is available in versions compatible with other printers (IDS, NEC, Okidata, etc.).

Microbuffer II by Practical Peripherals

The Microbuffer is also an excellent card with all the features of the Genie interface plus the ability to add 16K or 32K of RAM to the board. This additional memory acts as a buffer between the Apple and the printer.

Normally the Apple must send data to the printer a line at a time, then wait while the printer prints it. With the Microbuffer the Apple dumps its output into the buffer, then moves on to other tasks.

You can load the 32K buffer with four graphics screens, and instead of having to wait, you can return to programming or whatever while the Epson chugs through the four pictures. This buffer also works for printing text. Like the Genie card, the Microbuffer will work with other printers if the ROM chip is changed.

Pkaso by Interactive Structures

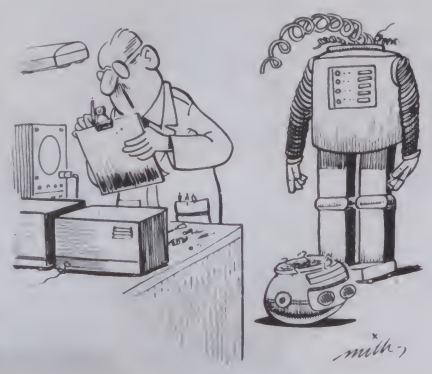
Of all the products considered here, the Pkaso is the most powerful. The Pkaso board itself provides five sizes of hi-res graphics dump, a lo-res graphics dump available in 16 shades of gray(!), text screen dump and text formatting control, and "SuperRes" dot graphics (960 x 792 points on 8.5" x 11" page). On disk you get to design your own special characters.

Pkaso is designed so that you can integrate these features into existing software for the Apple. Pkaso is even compatible with the Apple III. And best of all Pkaso has an excellent manual to explain the use of its wonders. Like the *Graphtrix* manual, the manual for Pkaso is printed on an Epson and speaks eloquently in form and content of Pkaso's power.

I am not sure everyone needs all these features, but the mountain is there if you want to climb it. As a simple graphics dump and parallel card, it is no more difficult to use than any of the others.

Conclusion

If you have an Epson with Graftrax, there are enough products that you are bound to find one that suits your desires for printed graphics. In fact, whatever printer you have hooked up to your Apple can probably print graphics with one of the items reviewed here. If not, wait a few months and someone will find a way. □



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John Anderson

It is a pleasure for me to man the outpost this month. It has been nearly three years now since I first unboxed my Atari 800, and I can report that it has performed unfailingly over all that time and heavy use. I'm not saying I have never had a system crash or lock-up, but the computer has never required any service beyond cleaning the board contacts once in a while (I can handle that).

The machine was and remains an engineering triumph, which is still ahead of its time in terms of capability and cost, as well as reliability.

Atari owners have had to be a tough-skinned breed now and then over the past three years, but that has changed. The "big three" are under the gun. Atari owners, now numbering over 300,000, know they made the right decision.

I am a member of this group, and a satisfying facet the hobby offers to me is the use of my machine to communicate with others who feel the same way I do about it: that the Atari is the best machine of its class, and that learning its secrets is an extremely pleasurable pastime.

Last May we instituted a call for reviewers, and many Atari owners responded. One thing that impressed all of us here at the magazine was our query concerning modems. Of the respondents who did not already use their microcomputers for telecommunication, nearly *everyone* responded that he had a modem on his "wish list," and that it wouldn't be long before he was hooked up. We have also had a very favorable response to the possibility of making *Creative Computing* downloads available over networks such as Compuserve and The Source. We are looking into this possibility.

The Modem Mystique

A great deal of potential presents itself. The possibilities of travel reservations, ticket purchases, shop at home services, a broad range of databases at your finger tips, are very exciting. Telecommunications herald a truly practical role for the microcomputer in the home.

I do not believe, however, that any of these practical notions constitutes the real basis for the "modem mystique." The thing that excites most people about microcomputer telecommunication is the opportunity to express themselves in a new medium, to tell others how they feel. They are less interested in using a modem to pay their bills than to state their opinions, to have their voices heard, and to respond to the voices of others.

The bulletin board service is growing in popularity. This is a phone line tied to a computer, running a program that accepts and displays information sent from other computers. The concept of the bulletin board is powerful and extensible. It creates a new kind of forum—a medium of communication—through which ideas can be expressed, shot down, modified, and spread. The importance of this kind of interaction, and its potential, is now being discovered. I think it may be a while before it emerges as a medium of major influence, but it *is* going to happen; it's happening now.

I maintain contact with about five Atari bulletin boards regularly. I enjoy leaving messages as well as reading what others have to say. I check the download files to see if there is any software worth trying out. I find out what other Atari owners are thinking about, as well as expressing my own thoughts. I may even start a "real-time" conversation with someone at the other end.

You may be a new user with questions concerning hardware. You may be an assembly language programmer wishing to share the results of a routine you have developed. Or, you may simply wish to voice your opinions concerning *Tron* or *E.T.* or to boast of your latest score at *Zaxxon*. The bulletin board is a worthwhile place to do it. Your thoughts join other thoughts, in what amounts to a marketplace of ideas—ideas that are shared.

Communication via computer may seem at first to be rather impersonal, but this is not the case. Through what other medium might you become involved in a lengthy philosophical chat with a sysop (system operator) hundreds of miles distant and at three in the morning? It is almost like being able to call your own user's group meeting whenever the mood strikes you—and then adjourn it without muss or fuss. It is at once personal and yet distant: and therein lies its unique value.

So get that Atari of yours talking to other Ataris, the way you've planned.

The Forth Wave

A very hot topic on nearly every board I have logged onto lately is the Forth language. This language offers hope to folks frustrated by the slowness of Basic, limitations of Pilot, bugs in APX Pascal, and obscurity of assembler. Although it has its own unique little quirks, Forth seems to be a natural for the Atari machine.

There are many implementations of the language available for the Atari, but the definitive version now seems to be Valforth, from Valpar International, 3801 E. 34th Street, Tucson, AZ 85713. We have received four packages from them, each of which shows a high level of professionalism and promise.

Valforth is a debugged and improved version of APX Forth, and is available with a powerful screen editor and utility package; a player missile graphics package, character and sound editor; and a display list formatter. We were able to create very smooth multicolored player/missile animation as well as modified

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display lists with very little fuss. The speed of movement is not as fast or as smooth as machine code, but is many times faster than Basic, and quite acceptable—so are the ease with which these packages can be used, and their reasonable cost. I hope to present a thorough evaluation of all the Valpar packages in the near future.

Despite whatever you may hear to the contrary, you need not renounce your worldly ways to grasp Forth. Nor does mastery of Reverse Polish Notation cause hair loss or halting speech. Sure, the language has its peculiarities, but that's the challenge, right? Anyway, whenever you hit a real snag, you can ask for help on a bulletin board service! There's nothing like access to someone who knows the answers when you're trying to learn something.

Another byproduct of accessing user's group bulletin boards is the spreading of rumors. One such rumor I discovered on the MACE BBS has lamentably been confirmed: John Harris, brilliant young author of *Jawbreaker* and *Mouskattack*, had the only extant source code for his latest work, *Frogger*, stolen during a charity benefit. It is hard to understand what the thief had in mind—if we assume the thief had anything resembling a reasoning mind. What could he have hoped to gain by stealing the source code of an unfinished program? This will certainly forestall the release of *Frogger* for some months, and is sure to have put a real crimp into John's summer, if not his year. Upon capture, the thief should be forced to play Crystalware adventures to their solution or the thief's collapse, whichever comes first. (Are you taking any bets?)

"First you lull them into a false sense of confidence with a couple of perfect runs..."

Other Atari Bulletin Boards

R=Ringback L=Limited service

Type	Name	Location	Phone
AMIS	—	Atlanta, GA	404-252-9438
AMIS	APOGEE	Miami, FL	305-238-1231-RL
AMIS	—	Baton Rouge, LA	504-273-3116
AMIS	ARCADE	Detroit, MI	313-978-8087-R
AMIS	—	Chicago, IL	312-789-3610
AMIS	GRASS	Grand Rapids, MI	616-241-1971
AMIS	MACE	Detroit, MI	313-868-2064
AMIS	MLBBS	Madison, WI	608-251-8538
AMIS	SB-12	Boston, MA	617-876-4885-L
AMIS	SPACE	Seattle, WA	206-226-1117
AMIS	TEAM	San Jose, CA	408-942-6975-L
ARMU	ARMUDIC	Washington, DC	202-276-8342
ARMU	FLEGLG	New York, NY	212-598-0719-L
ARMU	GREKLCOM	Oklahoma City, OK	405-722-5056
ARMU	PACE	Pittsburgh, PA	412-655-3046
ATBBS	—	Honolulu, HI	808-833-2616
TARI-BOARD	—	Denver, CO	303-221-1779
TARI-BOARD	—	Atlanta, GA	404-252-9438
CBBS	CP/M	Detroit, MI	313-759-6569-R
RBBS	CP/M	Allentown, PA	215-398-3937
RBBS	CP/M	Chicago, IL	312-789-0499

The "type" of bulletin board indicates what program is run on the host computer. Each program has its own strong and weak points; ergo each has its own adherents and detractors. It's all part of the fun.

AMIS stands for "Atari Message and Information Service." ARMUDIC began as a mnemonic for the phone number of the original service.

"Ringback" means to let the phone ring once, hang up, count to five, and redial. This allows a single line to serve as a voice and modem connection.

"Limited service" means the board is up only part-time, as opposed to 24 hours a day. If you can connect once, the hours will be listed for you.

These numbers were compiled by the MACE BBS, which is one of the most popular Atari boards in the country. Our thanks to the Michigan Atari Computer Enthusiasts for this list. Give them a call!

Poking Around

I have yet to see a *definitive* list of memory locations for the Atari in any manual, periodical or book. We are compiling a list currently, and it will appear soon in the pages of *Creative Computing*. In the meantime, here is a very brief collection of some of the most interesting locations, and what values to POKE them with (all values in decimal):

65 - if = 0, I/O data transfer tones from TV or monitor will be disabled. Load will take place in silence. Nice with titles or especially music, to suppress "noise." If location 65 < >0, I/O will be audible.

77 - if = 0, attract mode will be suppressed. It is surprising to me how many programs are missing this simple POKE in any loop of less than nine minutes duration. Although designed to prevent "burn-in" on an unattended machine, this mode drives me nuts. If location 77 = 128, attract mode is enabled without nine-minute clock countdown.

752 - if = 0, makes the cursor "invisible." I say invisible rather than disabled because the cursor still functions as if it were visible. Nice in title cards and text programs to clean up screen "look." If location 752 < > 0, cursor will be visible.

82 - if = 0, enables 40-column screen width. The Atari defaults to a 38-character screen width, which was a good thing for me when I used a regular color television with the computer. "Overscan," as it is called, cut off the left-hand side of the screen. When I upgraded to a color monitor (much to my wife's relief), I noticed two unused columns on the left side of the screen. A simple POKE brings them into play. If location 82 = any number from 0 to 39, that number becomes the left-hand column. The default value is two.

83 - Same as above but for right-hand margin. Default is 39. Less call for this one, but nice to know, anyhow. Right?

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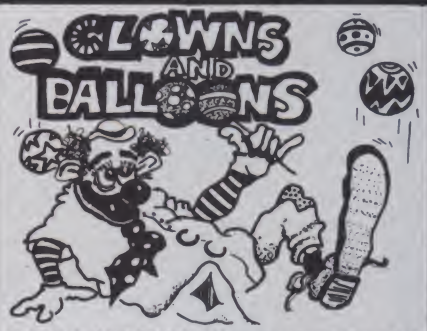

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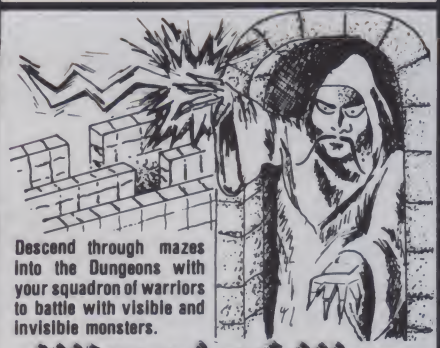

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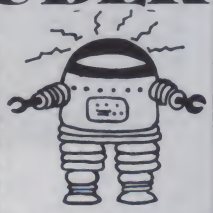

A secret research installation is protected by two robo-units whose one purpose in life is to destroy all intruders. A major earthquake has struck this region. The "hot room" is a shambles! A meltdown at the installation is imminent! Your job is to guide a repair robot into this area and avoid being caught by the mad robo-units.

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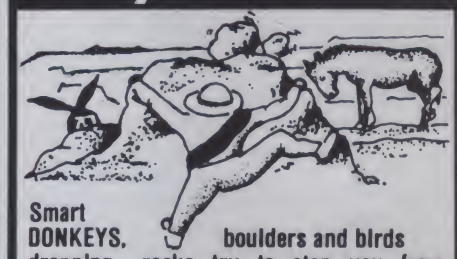

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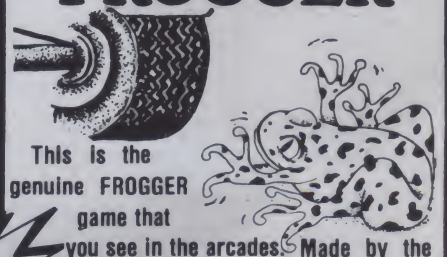

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CIRCLE 268 ON READER SERVICE CARD

Third party game software for the Atari 400/800 computers continues to pour in to the magazine. Let's take a look at just a part of the cream of the latest crop:

A Very Grand Canyon

Datasoft was among the first commercial third-party sources of Atari software, and the quality of their product line has remained consistently high. *Canyon Climber*, by Tim Ferris, sets a new standard for Datasoft, as well as one that challenges comparison.

Beginning with strains of Bach, *Canyon Climber* sets its own tense, yet humor-filled pace. The musical opening is superb; it is hard to tell whether you are listening to your computer or a cut from the album "Switched-On Bach." How Ferris manages the tone sustain is a mystery to me.

Suddenly the music vanishes, and your lone figure is left, clinging to a narrow canyon trail while dozens of surly, half-crazed billygoats seek to topple him from the precipice.

You are without weapons in your attempt to scale the many paths and ladders. Your only edge is a near ballet-like ability to leap into the air. If you time your leaps just right, you can hurdle goats on the fly. Your timing is crucial, of course; beginners will almost certainly earn a lot of horns in the keester.

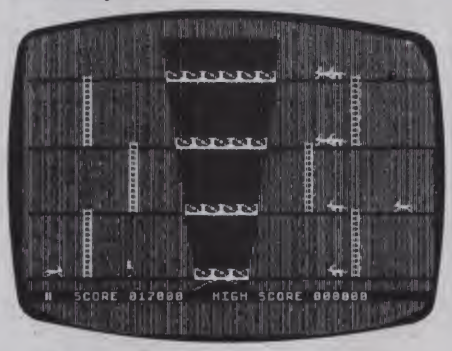
The first task is to place explosive charges across a set of bridges spanning the canyon. Dodging oncoming goats from all sides, your fearless climber scales the sheer cliffs. And, upon reaching the detonator, you blow the bridges. This will hold the billygoats for a while.

However your problems are just beginning. The screen changes, and you find yourself at the foot of another set of cliffs.

Billygoats were child's play. Here you meet a very sedate group of Indians: they neither move nor make a sound. They simply and continuously shoot arrows at your face. Hope you've been practicing your pirouettes.

At a couple of these cliffs you will find a shield, which may help fend off a few arrows. Be careful though, because your shield may disappear at any time. Carrying it also makes ladder climbing tougher, as you cannot climb a ladder while carrying a shield.

If you are lucky enough to make it past the Indians, you are greeted by a final set of cliffs. You can see the top now. In the sky above, great birds hinder your progress by dropping, well, bricks in your path. The trail itself becomes quite tricky, as the way is broken by deep fissures. One misstep and you'll be goat feed by the time you hit bottom.



Finally you reach the top, just long enough for a breath of blue sky and a bit of Bach before the head billygoat butts you right back down to where you started. This time the going will be even tougher.

Canyon Climber achieves a cartoon-like atmosphere in the rendering of its various screens, to very pleasing effect. Your figure has blond hair, and wears a blue shirt with jeans. It actually seems to throw a shadow on the canyon wall, as well. The animation is smooth and the colors superlative.

You will spend a while with *Canyon Climber*. It took me a couple of days just to reach the top on a regular basis. Now I have begun to work on my score.

Send Up the Clowns

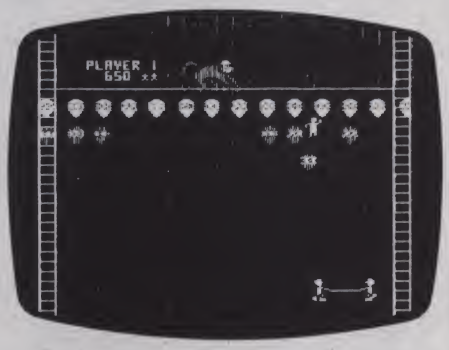
Several epochs ago, when I was a lowly undergraduate, arcade games were just beginning to use video screens. I remember an early one called Circus, and that it sat between Tank and Pong in the student union. Ah, those were the days.

"Oh, no," was my first thought when I loaded *Clowns and Balloons*, also from Datasoft. An exhumation of Circus: where is author Frank Cohen's respect for the moribund?

This report was exaggerated; I was dead wrong. This may very well be the most addictive game I have seen since *Threshold*.

In *Clowns and Balloons*, you manipulate a trampoline, shooting your player ever higher, as you try to break as many balloons as you can in your trajectory across the screen. The concept is simple, but play is not. You must anticipate where to move that trampoline at all times. Otherwise, in the flick of an eye, your player will land in a headfirst heap on the floor.

Stone Age devotees of the black and white coin-op Circus will especially appreciate the sophistication of *Clowns and Balloons*. The trampoline is carried by two silver-haired clowns, whose outsized shoes scamper wildly as they run from side to side. The balloons spin and shimmer as they glide across the screen, and they do so in vibrant colors.



The music, as in *Canyon Climber*, is superb. Even after I landed on my head, I found myself humming along with it. Again, all factors work together to form an "atmosphere" about the game. It is as if it were a cartoon rather than a computer representation. It works very nicely.

It was easy enough for me to predict that my bevy of kid playsters would go nuts for *Clowns and Balloons*. They liked it nearly as much as I do. Fortunately, they belong to someone else, so I can play to my heart's content after they have gone home to eat dinner. Three levels of difficulty keep the action at a "breakneck" pace. □

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SOFTWARE PROFILE

Name: Canyon Climber
Type: Arcade game
System: Atari 400/800 16K
Format: Cassette/disk
Language: Machine
Summary: You'll want to gorge yourself
Price: $29.95
Manufacturer:
Datasoft Inc.
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SOFTWARE PROFILE

Name: Clowns and Balloons
Type: Arcade game
System: Atari 400/800 16K
Format: Cassette/disk
Language: Machine
Summary: Balloonatic adventure
Price: $29.95
Manufacturer:
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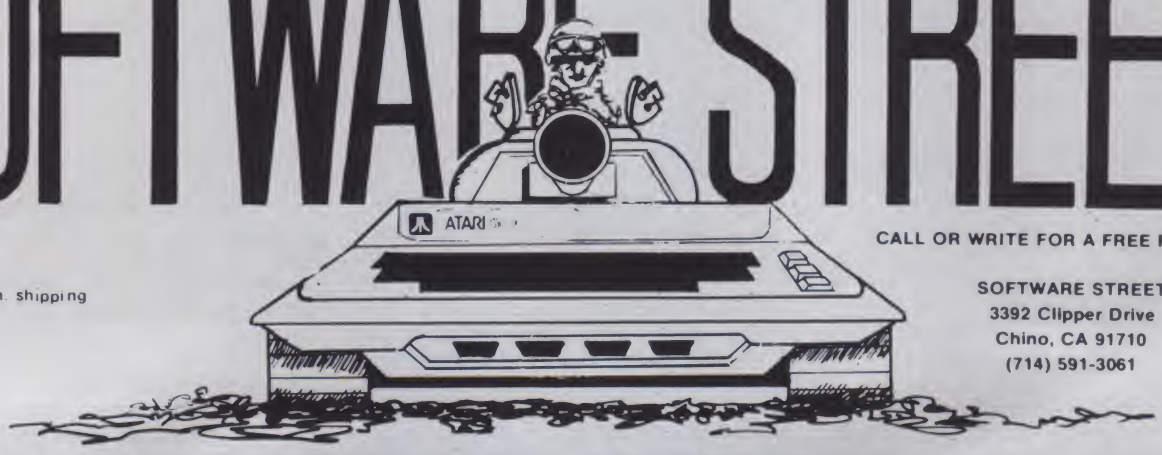

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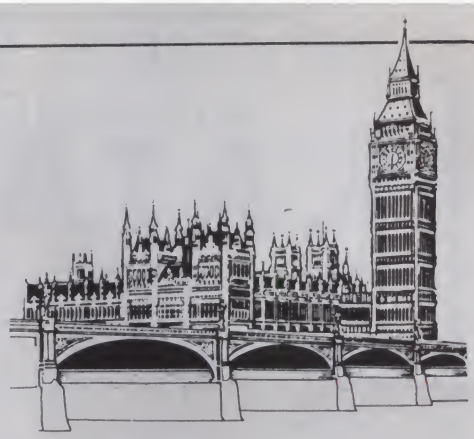

side...the other side...the

Guy Kewney

If you can't impress the bankers with a launch plan, there is always the government. Or at least, there always used to be the government.

A lot of plausible people in the micro business are becoming very frustrated by the present British administration's reluctance to invest direct funds in worthy causes—in particular the Plausible Person's Get Rich Quick Fund.

Time was when raised eyebrows and a wagging finger could generate quite a tremor of fear, coupled with suggestions that Our Trade Position might be threatened if we didn't take steps to sponsor development work in one area or another. That time, it seems, is past.

Currently, the biggest failures as political scare images are the Japanese.

The government was persuaded last year that a year of celebration and festivities under the title Information Technology Year would be a great publicity idea: naturally everybody who put Margaret Thatcher up to this inevitably thought that a whole sequence of money-making and fund-gathering projects would follow. There was even talk of an IT Year Micro.

It is now mid IT Year, and word is that the IT Micro was doing very well on the normal rungs of the civil service ladder, until it got high enough that people in Downing Street (where the Prime Minister lives) could see where it was going. Chop! "Government no longer intervenes directly in industry, but leaves market forces free to operate," came the old, familiar phrase.

It was a grievous blow to Commodore, which happens to be the biggest micro producer here, but happens also to be regarded as an outsider.

The company has been working very hard on its British image, pointing out that none of the UK staff comes from America, and that much of its production is in Europe. And, added officials, we are prepared to be much more British, if only we could get a little recognition.

It got to the point of pantomine when Jack Tramiel arrived, gave interviews (fascinating, educational, thought-provoking as always) and spiced them with the quaint notion that Commodore's failure to sell as well in America as it had in Britain, was deliberate.

"I'm very glad," said Jack with a straight face, "that we had the restraint(!) to stay out of the games market, and concentrate on developing business applications in Europe."

He then vanished across the Atlantic with his trusted British assistant, Kit Spencer, who it is rumored, had "borrowed" one of Clive Sinclair's new pre-production ZX Spectrum models for the night. There was subsequently an almighty fuss, and the machine is said to have returned mysteriously the next week, with all its colors back to front—almost as if somebody had been analyzing the circuitry and hadn't been able to put it back together properly...but that, of course, is another story.

Commodore's suggestion that it might consider setting up a factory in Britain if it were given the contract to design the IT Year Micro, however, vanished into the black hole down which most requests for government sponsored contracts vanish.

Meanwhile, plausible people were still selling the idea of the Japanese threat, and the Fifth Generation, which they somehow manage to call the Veeth Generation.

Expert Systems became the buzzword of the age. "We know very little about what the Japanese are planning," was the message, "apart from the fact that they plan to take over the information technology world, and all the jobs that go with it."

And, it was pointed out, we also knew that Japanese information technologists were doing much of their development work around a language called Prolog, which is used to write expert systems.

Expert systems are not meant to be thought of as just databases full of detailed information on how to recognize the sort of plants that grow where oil may be found, or how to detect advanced renal cancer in a patient who has other kidney symptoms, but instead are the key to designing really understandable software.

The idea is that computers are programmed in logic rather than in detail. And, when the user enquires "How did it do that," it should be able to answer in terms of the application, rather than the screen and memory manipulations it has to perform.

Instantly, Micro Prolog was launched for CP/M machines, Micro Expert was reduced in price, and Lisp compilers began to be written for all sorts of esoteric machines, including the now famous British Broadcasting micro.

The Prolog interpreter is by far the most interesting of them all, despite the rather modest claims made for it by its

producer, Logic Programming Associates.

To quote the publicity blurb that came with the launch, "The net effect of forty years of development of programming languages seems to be that there are very few programmers, and that very few of these programmers have any solid confidence that their programs are correct. Programming is still a craft activity."

The company compares this "craft" activity with most other modern production and design activities, (typically highly automated) which use sophisticated (computer based) aids for designing and manufacturing products.

Why not in programming, they ask. "One way of tackling the programming problem is to provide a programming language which is descriptive rather than prescriptive; and in which programs are descriptions of the input/output relation to be satisfied."

In other words, the program is a definition of what the program is supposed to compute, rather than a prescription of how it should be computed.

Current uses of Prolog are as a language for artificial intelligence research, an area of deep fascination, but still relatively little productive development—unless Prolog turns out to be the breakthrough.

As LPS points out, Prolog is not particularly suited for applications which require a great deal of routine numerical work, nor for a fair amount of real-time and commercial data processing work. "However, in these fields, logic is still a suitable specification language," they observe, "and Prolog can be used to speedily implement and test a prototype program."

For those who understand Prolog parameters, this version of the language is capable of 240 "resolutions per second" on a Z80 micro at 4 MHz, and the interpreter occupies 15K of memory. A system of at least 32K is needed to run it.

Compared with standard Prolog, Micro-Prolog is bigger, not smaller. It has significant extensions including an interactive editor, to which micro users have become accustomed with Basic editors, plus modules, and random access files.

Apart from that and similar interesting developments, however, there is no sign of much money coming forth from official coffers. The best that can be done, it seems, is to put up another £9 million sterling to supply computers to primary schools (children up to 10 or 11) having already seen a successful program to put micros (at least one per school) into secondary education.

The program, run by the Department of Industry with the Department of Education, has an awful long way to go before even a majority of children in these schools get to dirty the keyboards with their fingers, let alone do serious work. But it is designed to "prime the pump" rather than solve the problem.

The really irritating thing, from Commodore's point of view, however, is the fact that once again, its products have not been approved. Primary schools are to be given a choice between the two traditional school micros, the Acorn-built BBC micro, and one built by educational specialists Research Machines.

There is also a new machine on the list. It is the Sinclair ZX Spectrum.

If all this effort to hold up the spectre of the Japanese as a threat to our trade continues to fail, our respectable Great and Good Plausible People may be forced into their serious attacking posture, which is really needed only in desperation.

It hasn't quite come to that yet, but I rather think that in the next couple of months, we will start hearing the first suggestions that Expert systems, especially on micros, could have Serious Strategic Value.

Governments are known to be helpless in the face of such an onslaught. □

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Will Fastie

My father hates computers.

Well, that's what he says when asked, although he just told me he is getting (maybe) an IBM Personal Computer to use for word processing. I guess he could use it and still hate it.

Has my father ever told you that he hates computers? He'll make a point of it if you go over to him and compliment him on his writing for this magazine! AHA! The plot thickens.

My dad is a famous (well, in the right circles) physicist. His name is *Bill* Fastie. Lots of people know him, and think it's just wonderful he writes this column. Dad tells me that he carefully explains the true circumstances, but then I got a letter from a reader who says she called me to ask a question, got Dad by mistake, talked with him, was charmed, and fell in love with him, and then promptly forgot to call me. Charmed? Dad? Egad.

Now I have this dream about my father: he goes to a bar, announces to no one in particular that he hates computers, and is immediately mobbed by women. Meanwhile, in another part of town, I sit hunched over my PC, cranking out another column for him to get credit for.

I hate physics.

Languages

This issue of *Creative* gives me a long-awaited opportunity to tell you about the programming languages available for the IBM Personal Computer. There are quite a few, and the number is growing rapidly, considering that languages are usually of interest only to software developers and others with special programming requirements. Nonetheless, I think my comments here have a broader appeal, and may answer some of the questions you users might have about software development and programming.

I can't afford the space to give you a detailed analysis of each programming language. Also, although I hate to admit it and destroy any thoughts you might have about my omniscience, I don't know enough about all of these languages to do so. What I have done is borrowed heavily on the superb work of Jim Gilbreath and his article in the September 1981 issue of *Byte* entitled "A High-Level Language Benchmark." In this article, Mr. Gilbreath examined ten languages on scores of computer system environments and collected the results into what has become a "benchmark" study. In fact, several of the language compilers which I will mention are delivered with a copy of Mr. Gilbreath's benchmark program.

The program (I should say *"algorithm"*) is called The Sieve of Eratosthenes. It is a technique for finding all the prime numbers up to some maximum value, in this case 16,380. The algorithm is nice because it does not require the use of multiplication and division, and the resultant programs are less different and thus better compared. For details on the algorithm, and for purposes of comparison, see Mr. Gilbreath's article.

Table 1 summarizes the results I obtained from each language system tested. I chose the values shown in the columns because they give clues about each compiler, as I will now explain.

The compilation time is a measure of how fast a compiler runs. Although most software developers are more concerned about how fast the *compiled* program runs, the speed of compilation gives an indication of the efficiency of the compiler, and thus how well *it* might be written. As you can see, the times are very close. The Basic compiler scores very well here, probably because it does not have to do as much work as the other compilers.

Object file size is an indication of how efficiently the compiler generates its output. This is a looser measure because different compilers produce different types of output. Among compilers of the same type, however, the object file size is interesting. The two C compilers listed have vastly different sizes, by a factor of 17, and the reason escapes me. Since the IBM PC diskette drives are relatively small (especially mine), I'd lean toward the compiler producing the smallest files, all other things being equal.

Executable file size is an absolute measure, and diskette sizes are only one reason. The invocation of a program which is smaller is also faster because less program has to be transferred from disk to memory. I lean very strongly to languages producing smaller executable files. The IBM Basic Compiler seems best at this, although a second executable file called BASRUN.EXE must also be loaded. The disk storage is optimal

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Table 1. Sieve of Eratosthenes Benchmark Results.

Compiler and (Vendor)	Compilation Time	Object File Size	Executable File Size	Execution Time
Basic Interpreter (IBM/Microsoft)	—	—	—	2430 (1)
Compiled Basic (2) (IBM/Microsoft)	1.7	1267	1536	300 (1)
Compiled Basic (3) (IBM/Microsoft)	1.8	1709	19072	220 (1)
Fortran (IBM/Microsoft)	13.9	2079	68736	777 (1)
Pascal (IBM/Microsoft)	12.0	1015	32640	76
PC/Forth (Laboratory Microsystems)	—	—	—	56.4
C86 (Computer Innovations)	7.6	512	9472	22
Lattice C (Lifeboat Associates)	7.0	8777	19072	11
Cobol (IBM/Microsoft)	12.1	3411	7424 (4)	416 (5)

(Times in seconds; sizes in bytes.)

Notes:

(1) Actual program performed one iteration and the resulting time was obtained by multiplying by ten.

(2) This time was obtained from the compiler option requiring use of the runtime module BASRUN.EXE.

(3) This time was obtained from the compiler option forcing a full search of the library and resulting in a stand-alone executable program.

(4) Requires COBRUN.EXE runtime module to execute.

(5) Cobol entry is included for information only. Run time is not valid (see text).

nevertheless and the load time is average. IBM Fortran appears the worst, producing an enormous executable file for a program of only 25 lines.

Execution time is the most interesting value to just about everyone. Ultimate efficiency of the program is pleasing to the developer and impresses the buyer. For some applications, it is just plain critical.

One item in the table is included for information only, as the results are not valid in comparison to the rest. IBM/Microsoft Cobol has a limitation which prevents the algorithm from being coded directly. Instead of spending the time to rework the program to allow it to match the algorithm (which would have resulted in 1899 primes in the first 16,380 numbers), I ran it to its limit (302 primes in the first 2000 numbers). Since it took 416 seconds, I wasn't worried about misrepresenting the Cobol compiler.

For me, there were two real surprises. The first was the Basic Compiler, which improved the performance of the program by one order of magnitude (a factor of 10). That result is quite satisfactory, and I have experimented with several programs, many of which have benefitted significantly. I can think of several programs for the PC which could also benefit from the application of the compiler. The second surprise was the performance of PC/Forth. At 56 seconds it placed third overall, behind two high-powered C compilers, and ahead of every single IBM language — quite impressive. Remember that Forth is a "threaded" language system, which is similar to an interpretive system without the overhead.

The two C compilers did pretty well against this competition, but not as well as I had hoped. Mr. Gilbreath chose the fastest Z80-based execution as his standard, which turned out to be Digital Research's PL/1-80 running in 14 seconds. He called this performance "1." The C86 program ran in 22 seconds, or 1.57, while 11 seconds for Lattice C rated a 0.79. Mr. Gilbreath reports a four-second execution time for assembly language on a 5MHz 8088, rating 0.28, which represents a better rating than the IBM PC's 4.77MHz 8088 can achieve. C on a PDP-11/40 produced a program that ran in 6.10 seconds, and rated 0.43. Based on this information, I thought that the C compilers should break 10 seconds.

The Lattice C compiler came darn close, and certainly recorded an impressive time. The C86 compiler was a little disappointing, but I should explain that I twisted George Eberhardt's arm to let me talk about his (Computer Innovations') compiler. He had asked me to wait until he had his next revision ready, the revision in which code generation would be improved. I appreciate the opportunity to talk about it, and his improved version should be available as you read this.

C is a pretty handy language in which to write systems programs. A system program is usually defined as a program requiring direct access to the machine environment, the best possible efficiency, special techniques, or other features unavailable in the highest level languages. Both the C compilers I tested are complete (C86 still has a few features missing as I write this) and compatible with the Kernighan and Ritchie specification.

They both support the Unix V7 interface. I like C86 a little better though. I think George is going to make good on his performance promises — you have to talk to him to see why I think so. But there is one very special feature of his library which indicates to me that he has thought things out carefully.

The C86 library has a routine called SYSINT. The purpose of the routine is to allow C to directly access DOS and ROM BIOS functions in the IBM PC. This is especially important because there are no functions available through IBM DOS that allow access to things like video display initialization, plotting points on a graphics display, or even positioning the cursor on the display. George has provided the "hook" that systems programmers need to get those functions. I like it, and I think it speaks well for his attitude. By the way, a programmer can certainly write the same function to support the Lattice C compiler, but it is not as easy as it might seem at first.

So I like the results from the C compilers, PC/Forth, and the Basic Compiler. IBM Pascal was acceptable at 76 seconds, although the executable file was somewhat large. On the bad side, the Fortran program ran very slowly. I have always thought about Fortran as having very good performance, but this version leaves some-

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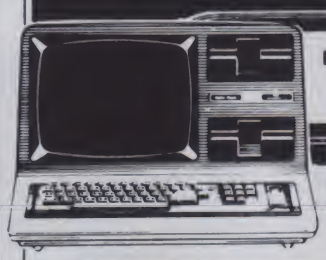

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thing to be desired. My friend Tom tried a quick experiment with Fortran. He wrote a program to display the first 25 numbers, their squares, and their square roots. I wrote the same program in interpretive Basic, and it ran twice as fast. No kidding.

Add to this the fact that Fortran has a relatively low numeric precision, and you have little reason to choose the language. In fact, those users with Fortran programs already should be warned about this version of Fortran for reasons of both performance and precision.

One more thing. I expected the Gilbreath programs to work as published, except for Cobol. In each case his programs are simple and use no non-standard features. This proved to be the case for C, Basic, and Forth. The Fortran and Pascal compilers both objected to the Gilbreath version, and I had to make some rather subtle changes to get a clean compilation.

Actually, the Pascal compiler didn't let me off the hook: the program still generates three warnings, and I learned only today what I had done wrong.

It is nice to know that the IBM PC is so well supported with programming languages, both by IBM and other vendors. There are languages from other sources than those I have mentioned, and they are listed at the end of the column.

Screen Editors

If you do a substantial amount of programming in a language other than Basic, you will have occasion to use an editor of some kind. Editor programs are similar to word processors, except that they do not allow control information in the text, they do not manage the ends of lines for you, and they do not usually know how to print "fancy."

They usually have several features specially designed for use by programmers and not needed by writers or typists; the most common is a *macro* facility which allows complex sequences of commands to be executed at the same time, or many times.

IBM DOS comes with an editor called EDLIN. With the exception of the creation of the tiniest files EDLIN is useless. No professional programmer will tolerate this editor for long. If nothing else, EDLIN is an inducement to buy a quality text editor.

Another possibility is the use of a word processor as a program editor. Many word processors support the capability if the user is careful. For example, as long as you force a NEWLINE at the end of every text line and prevent the word processor from "wrapping" to the next line, the text will be organized properly. You may have to avoid using tabs if the word processor embeds a tab character. And there are other things to avoid. The combination of these features that cannot be used makes word processors a questionable choice.

There are several editors, usually called *full-screen* editors, that are designed for program text editing. I have had a chance to try a few in the course of preparing the programs for the language tests, and here are my impressions.

Two particularly powerful programs are *VEdit* from CompuView and *PMate* from Lifeboat. These programs have many similarities and are really loaded with commands and thus, I assume, features. I tried both of these programs, and stopped using them quickly. The reason: I was unable to learn how to use them in less than 15 minutes.

Ted Nelson (and my friend Rich) has often said that a program is no good if it can't be used after ten minutes of trying. That is not exactly my position in this case, but it does apply. Remember that I am an experienced programmer (did you know that?), and I have used a slew of editors in my time. I know what an editor is supposed to do, and I think I should not have to spend half a lifetime trying to figure out the next one.

PMate and *VEdit* failed this test. They are powerful, but at the expense of considerable complexity. *VEdit* is simpler, with a one-page command

EasyWriter Revisited

I am certainly one of the harshest critics of the original version of *EasyWriter* offered by IBM. My criticism is unlikely to wane because I think IBM was foolish to have taken on such a poor product. Now IBM has announced *EasyWriter 1.1*, and it's time to take another look.

This column was prepared with *EasyWriter 1.1*, and I can say with some authority that the problems of Version 1.0 have been solved. My harshest complaints and the current situation are described below.

Reliability: The new version has never failed in any way. I do not have the lack of confidence that was so necessary when using Version 1.0.

Performance: Nothing less than a miracle. *Everything* in Version 1.0 was slow. Version 1.1 still has some slowness in certain functions, but the critical things like NEWLINE and insertion work much faster. It is no longer possible to out-type the program. Deletions are faster, although character-by-character deletion speed could be improved.

File System: All *EasyWriter* files are now DOS files. A conversion utility is provided to convert old *EasyWriter* Version 1.0 files into DOS files, and to convert text files, such as those produced by *VisiCalc*, into files *EasyWriter* can read. The conversion process from 1.0 to 1.1 is more tedious than it has to be, but it does work properly and it only has to be done once.

Printer: Version 1.1 handles the printer properly, as far as I can tell.

Human Factors: EasyWriter 1.1 works much more smoothly than its predecessor. The menus have been reworked and enhanced. Most functions work more naturally. Enough key sequences are different from Version 1.0 that it is not necessary to learn the program again.

Above all, the documentation is much better. A tutorial is included, and a greater level of detail is provided about *how* things work. Most things are explained better. I have only one complaint about the book I have (a final draft), something that might go away in the final version: the table of contents is spread throughout the manual, appearing in sections instead of in one place.

The best thing about *EasyWriter 1.1* is that owners of 1.0 can get a free upgrade. This is accomplished by taking the title page of the original manual to your dealer, who will order a new program for you. I'd say that's handling the problem pretty well.

EasyWriter 1.1 compares favorably with similarly-priced *Volkswriter* as of this writing. Because *EasyWriter* is a single program module as opposed to *Volkswriter's* two, I think I even prefer it slightly.

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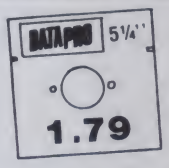

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A Harrowing Experience

You may remember that I complained about the lack of in-house service from IBM, and that I was unequivocal in my opinion (?) that IBM would not get my service dollar. Having one's system break is the best way to have one's feet brought down to earth, and that's exactly what happened to me.

One evening as I was writing, my Monochrome Display started to act up. The observed symptom was a loss of the display, followed shortly by its return. The first instance put my heart in my mouth, and I was dying when it happened the second time. Just as I began to worry seriously, the display dropped out for the third, and as it turned out, final time. Fortunately, I remembered what I was doing and I was able to exit the word processor without losing my work.

But what had happened? I took my copy of the IBM Advanced Diagnostics out and got to work. The rest of the system seemed okay. Following instructions for the display test, I got out my trusty VOM (volt-ohm meter) and took readings from the display adapter connector. They all matched, and at the end of the procedure were the words I was dreading: "Replace your display," along with directions to Section 3, "Removal/Replacement."

No problem, right? Just pop down to your local dealer and get it fixed? Well, er . . . that is, sure, if you happened to have purchased a service contract. Me? Uh, um, you know, it just slipped my mind. That's right, no service arrangements. So I began the process of calling both my IBM Product Center and my local Computerland store.

Without a contract, IBM politely directed me to the toll-free number and Greencastle, IN, home of IBM Personal Computer Maintenance. I tried calling them every ten minutes for six hours, and got a constant busy signal. (That many PC's broken, huh?)

In the meantime, I got through to Computerland. They seemed a little confused at first, but finally were able to give me pricing. The first deal was a trade-in for a new monitor, a simple replacement rather than repair, costing $320. Since the monitor only costs $345 to begin with, I quickly rejected that suggestion.

The second suggestion was time and materials repair at $42 per hour, which I thought was reasonable (IBM charges $96). However, Computerland indicated that they did not have the schematics or parts for the display, and suddenly T&M didn't sound too good anymore.

Although my calls to Greencastle never got through, I was able to piece together how that would work. First, I would ship the display to Greencastle. For a fixed fee, they would inspect the unit to determine the problem. They would then call me with a price for repair. If the repair cost exceeded some percentage of the original cost, Greencastle would replace my unit for that percentage.

I was rather depressed when I got home, and I decided to turn on the system to see if, by some miracle, the display would work. It did! And then it went away. In a fit of rage, I slapped the side of the display. It worked again! And then I knew what was wrong. With my trusty screwdrivers at my side I dismantled the display, plugged the two loose connectors tightly on the board, found out why they had been pulled loose and arranged everything so it wouldn't happen again, and closed it up.

Well, that put the fear of God into me, so I'm off to either IBM or Computerland for a service contract. I was really worried about having my PC available for writing this column, and I just can't risk it anymore. Time for insurance.

In the meantime, IBM maintenance pricing has changed quite a bit. Originally they priced each item independently. The new policy is considerably simpler and a little cheaper. The crux of the new deal is that everything contained in the system unit except memory boards and diskette drives is covered by single fee. The rest of the program is explained by the chart.

Item	Mail-in	Walk-in	Pick-up/ Delivery	%
System unit and keyboard, most devices	$130.00	$148.00	$185.00	7-12
64KB memory board	85.50	97.50	122.00	35
Each diskette drive	43.00	50.00	62.00	10-14
Monochrome display	46.50	53.00	66.50	19
IBM 80 CPS printer	125.00	143.00	179.00	32

Mail-in service means that the system must be shipped to Greencastle, IN. Walk-in means *you* carry the thing to IBM, and pick-up/delivery means IBM comes to you, and then returns it. The last column shows how much the service costs as a percentage of the purchase price of the component.

summary. The *PMate* command summary is almost *six* pages.

When *VEdit* is invoked, it clears the screen and leaves an * prompt in the upper left corner. That's it. From there, you better know what you are doing. *PMate* is a little better, because it provides some status indicators at the top of the screen and a line dividing the command area from the text area.

Unfortunately, the cursor appears to be in the text area, giving the impression that it is ready for text entry. It is really in command mode, just like *VEdit*. Both programs have very poor human factors. I know these programs are powerful, and I know they have a following, but I just don't like them.

A better-engineered editor is *Edix*, from Emerging Technology Consultants. This program is delivered with an on-line tutorial which is fantastic. It took about 15 minutes for me to get through, and I then knew how to work the program *without having had to crack the manual*. This tutorial is worth seeing for the experience, and I would even suggest a special trip to your store to see it.

That is the good part, though. I think the program itself is all sex and no substance. For example, *Edix* supports a split screen concept which allows up to four windows, each handling an independent file. That's overkill, because two independent screens are enough. The usual case for multiple screens is the desire to get a portion of one text file into the file really being edited.

In other words, you are working on file A, a new program. Your favorite subroutine is in file B, so you switch to the other screen, get hold of B, and find the piece of code. You then copy it into file A and continue the main edit. I just can't see why a third or fourth window would be helpful; they look very good in a demo, though.

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I had trouble getting used to *Edix*. The bulk of the commands are invoked by depressing ALT and a letter key. My problem was remembering what ALT combination did what, not right after my tutorial, but a week later. I can't have that. I must be able to go away for a long time and then get working again without pain. *Edix* has a help key, which gets you a list of all the commands on the screen. That's good, but not if you have to look at it all the time.

Edix has a couple of good features. It is very, very fast. Getting from one end of the file to the other happens at once, regardless of the file length. It will also take advantage of extra memory, giving a greater maximum file size that can be handled. *Edix* does not provide a macro capability.

I know what you are thinking: Okay, Will, if you don't like those, what the heck *do* you like? I can't tell you. Okay, okay, call me a tease. I promised the vendor that I wouldn't talk until they let me. Their editor, however, is *terrific*. It is as powerful as all the rest, it is simple to use, and its human factors are very good. I hope to be able to tell you about it next month. The company is entering the small computer field for the first time and is being very careful and conservative. Good for them! Hang tight: I'll tell you the minute I can.

New Products

Arlington Software+Systems has announced *PCHMS, The Personal Computer Home Management System*. I will have a review of this product next month because it is the first software package I have seen for the PC that is directed at the consumer market. It provides an address and telephone directory, a home inventory, insurance records, a credit card file, medical records, and information files such as telephone area codes. Functions provided include a 20-year calendar, metric conversion, and a printing calculator. Price is $89.95.

Ensign Software has released have one thing in common: they are very well written, and consistent in operation and behavior from one to the other. I was very impressed with the value of the games package at $29.95. Price of the *Cross Reference* program is $24.95.

Other products from Ensign include *ISAM Database* ($69.95), *Bowling League Statistics Manager* ($99.95), *HP7470 Plotter Demo* ($24.95), *Electronic Disk* ($69.95), bumper stickers (!?!?) with either "I OWN AN IBM" or "IBM-PCs EAT APPLES" for $2 each, and an ISAM Demo Diskette with documentation ($15.00). If *Games I* and *Cross Reference* are any indication, I have great confidence in these other products.

Practical Peripherals, Inc., has a product for the Epson printer called Microbuffer. This is a board that is added inside Epsons and provides 16K bytes of buffering. This allows rather large files to be printed without having the computer wait. I got one of these cards and put it inside my IBM 80 CPS version of the Epson, and is it terrific! I tell *EasyWriter* to print a few pages, the printer starts, and *EasyWriter* says OK, now what? I love it. The only disadvantage is that once you get that memory loaded, the printer runs until the buffer is empty. The only way to stop it is to turn the printer off. The 16K Microbuffer is $159.

I have mentioned the NEC 3550 Spinwriter before. It is the one with the parallel interface that plugs into the same printer adapter used to drive the IBM Printer. What's new is that IBM Product Centers will now be carrying the device. I am really surprised. This is the most expensive non-IBM product to be carried by IBM, and goes contrary to my guess that IBM would provide their own letter-quality printer.

I don't have an official price from IBM, but it appears to be standard list. Note: the fact that IBM sells this printer means that they will have to support it in software. That makes it PrtSc key. Starside's *Frieze* also works from PrtSc, but requires some keyboard input after that. It can also dump a file from disk.

Next month: as many games as I can find! □

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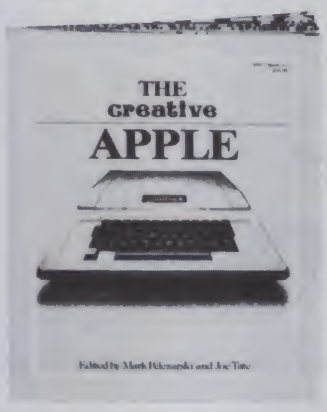

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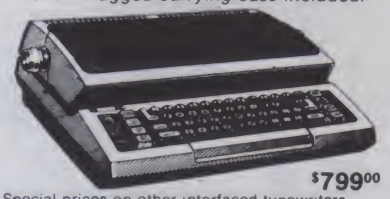

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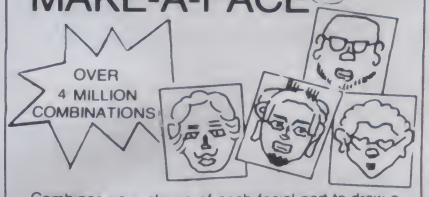

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Get This Book!
Programming The PET/CBM *****

As some of you old timers remember, I was once working on a comprehensive book for the PET. This project will never be completed for a very good reason: there is a far better book now available. *Programming The PET/CBM* from Compute! Books ($24.95) is 504 pages of densely packed, thorough and complete information about our favorite machine. Hats off to Raeto Collin West who has given us this masterpiece.

Organizing the huge mass of material on the PET is a very difficult task and Mr. West has done an excellent job. The book is intended as a reference book; don't expect the step by step "do this, now do that" approach of beginning and intermediate books. Use the index (which is quite good) to find the item you need. If you try reading from cover to cover, be warned: if you are not an expert, much will be beyond your understanding.

Many, many machine language programs are given as practical examples. For example page 60 covers DUMP, which is not a Basic command, and gives a screen dump program in both Basic and 6502 code. I won't waste space saying more—*get this book*.

VIC Revealed ***

Once you have mastered the two books by Commodore on the VIC, there is another one for you to consider, if you have mastered Basic and are getting comfortable in machine language. *VIC Revealed* by Nick Hampshire for Skyles Electric Works ($15.00) contains most of the things you need to know about the VIC for writing games.

For truly advanced programming you will need a complete assembly listing. I do not know of one that is commercially available yet. (If you have one, let me know.)

Nine Ways To Write A Program Languages For The PET

As this issue of *Creative Computing* emphasizes languages, I collected all of the programming languages I could find for the PET. The virtues of different languages are described elsewere.

For comparison I decided to write the same program in each language, give you the code, and report on the performance of the language in running time, time to write the code, time to debug the code, and space used. See Figure 1 for the detailed comparisons. As for style, look at Figure 2 and decide for yourself which versions look best.

The benchmark program fills a 40-column screen with the character set starting with @ (zero POKED to the screen) and then repeats starting with A and so on until the screen has been filled 256 times. The jiffy clock is checked and the time is reported in seconds. Several of the languages did not have the PET clock so I used PEEKs to locations 141, 142 and 143 to read the clock directly. Some of the languages did not have floating point numbers so I merely print the PEEK values and used my calculator to convert into seconds.

I tried to write each program so its structure was as similar to the Basic program as possible. This does not provide the best way to do the program in each language. For example, the Pascal version ran twice as fast (i.e. 19 times faster than Basic) if the procedure DOAPAGE was eliminated and the equivalent code put in the main program. The star ratings for the languages merely indicate my personal feelings about the language.

PET/CBM Basic ***

It is only fair to begin with the language already in our PETs. On one hand, Basic has its problems, most of which relate to features I would like to have but don't. On the other, I can write Basic programs almost in my sleep because I have used it so much. Basic also serves as a marker for comparison with other languages, especially in program size and speed. The times required to write and debug the code were short due to my skill in Basic. The write and debug times in the other languages could be cut by a factor of three or four if the programmer were skilled in the language.

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Figure 1: Comparison Chart for Languages Benchmark.

Language	Time to Write (min)	Time to Debug (min)	Time to Run (sec)	Size in Bytes	Speed Ratio to Basic
PET Basic	7	3	4368.7	302	1.00
Comal	20	15	3097.0	Note 1	1.41
Petspeed	Note 2	Note 2	674.5	159	6.50
Oxford Integer	20	23	37.0	612	118.0
KMMM Pascal	45	60	460.1	556	9.5
Forth	30	30	151.9	Note 1	28.8
RPL	20	7	157.9	122	27.7
Vigil	45	20	2525.2	499	1.73
Assembler	35	25	6.1	105	716.2

Note 1: The size of the program wasn't easily determined.

Note 2: Use PET Basic plus 1 minute to compile.

Assembler is clearly the winner in execution time and space usage. The write and debug times for languages other than Basic reflect my inexperience with these languages. Divide these times by 2.5 if you are familiar with the language. Note that the program sizes do not include the space required by the run time packages of the languages. (For example, Petspeed needs about 8K for its runtime code package.)

Comal ****

Comal from the Comal User's Group is rather like a Basic with a zillion new features to play with and try out. I particularly liked the way Comal would insert understood syntax without my bothering with it. For example, X=5 would list as X:=5. Comal is a compiler, however, so debugging by direct commands like PRINT X will not work. A mixed blessing is its line by line checking of syntax. If you flub a line, Comal will yell at you immediately. In some ways, Comal is like Pascal with many of the niggling details removed. Comal is available for $47.50 for all Pets, including a ROM version for the 8032.

Petspeed Compiler *****

As I described Petspeed from Small Systems Engineering ($325) in an earlier column this will be brief. If you have already written and debugged your Basic program, Petspeed will read the disk version and compile it for you. The resulting program will run from three to ten times faster than the original. (Speed is highly variable depending on the kind of program you write. The benchmark runs 6.5 times faster than Basic.)

Oxford Integer Basic Compiler **

This compiler from Skyles Electric Works ($200) requires that your Basic program be limited to using integer values only. This is the beginning of many, many limitations, some of which border on the bizarre. The final blow is that you can't backup the master disk. The compiler is written in Basic, so it runs slowly (Challenge: compile this compiler in Petspeed.) Doing the current benchmark wasn't too hard, but it took its time going through recompilations for debugging.

OIB does have some nice features like the ability to write interrupt code (I used this for the clock) and "wedge" type routines. The speed is impressive; only assembler ran faster. If you need it, use it, but it isn't easy.

KMMM Pascal ****

There are several versions of Pascal around, most of which are really p-code interpreters. That is, the Pascal is translated into an intermediate language known as p-code and a run time program simulates the p-code machine. This will run four to six times faster than Basic. KMMM Pascal from Wilserv Industries ($85) and AB Computers is a true compiler with the output in machine language—and it runs faster.

One caution: KMMM Pascal is not the full Pascal as defined by Wirth. It has quite a bit more than Tiny Pascal, but some features, such as user definable types, are missing. A fuller version is under development.

Pascal takes getting used to, particularly in the details. Willi Kusche (author of KMMM Pascal) was very helpful in debugging the benchmark program and spotted some errors I would never have found.

Forth ****

I am an utter neophyte in Forth so its unusual style set me back a bit. I expect that some practice may convert me, though I find the code almost unreadable. (That is an advantage, for you have to *think* your way through a program. You can't skim—and miss things.) This version from AB Computers is a full FigForth including screens on the disk, which is an essential feature for the serious programmer. It costs $50.

Forth runs at about 30 times the speed of Basic, which is really noticeable. One warning: business or scientific number crunching is difficult in Forth. The extensibility of the language is nice and the availability of direct mode commands is most helpful in debugging.

RPL ***1/2

RPL (Reverse Polish Language) from Samurai Software ($49.95) is superficially like Forth in the style of programming used (I wrote the benchmark by using my Forth program and substituting the differently named operators). Internally, RPL compiles into p-code so programs of moderate size should take less space and run faster than Forth. This didn't show up in the benchmark I used.

RPL comes with an extensive debugging program ($39.95) which I didn't have time to examine closely. You can execute your program step by step and still use the original labels, which is nice. (Any assembler builders out there? A Symbolic Debugger for 6502 programs is greatly needed.)

Vigil *

Vigil from Abacus Software ($35) is touted as a way to write game programs which run more rapidly than Basic. Features for looking at the keyboard and user port (joystick), and rapid plotting in half-square graphics are included. The benchmark in Vigil is cryptic. I had to resort to some machine language to do the POKE to the screen. Vigil uses only 8-bit values, which I find is a negative feature.

Vigil also runs slowly, which was quite a disappointment, and is a very limited language. An apt comparison is Tiny Basic vs. Microsoft Basic. Vigil is available for the VIC.

6502 Assembler ***

Just to see for myself, I coded the equivalent program in assembly language,

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and just to be nasty, I took advantage of th 6502 arithmetic to make my program a little bit faster. Machine code in this case is not a mere 100 times faster; it is *700* times faster. The assembler used was Bob Skyles's Macrotea, which is similar to Moser's ASSM/TED from Eastern House Software ($169.95).

High level languages are very worthwhile when it comes to saving my time as a programmer. Assembler is very worthwhile in its ultimate freedom regarding the machine and its speed.

Introducing Marc-Thomas Clifton

The following are some remarks by Marc-Thomas Clifton concerning adventure and fantasy role-playing (FRP) games for the PET. Marc will appear now and then in this column.

About Adventure and FRP Games

The Original Adventure was adapted to the PET by Jim Butterfield. Adventure is hard to find, but with a little help and a few friends, you should be able to obtain a copy.

Original Adventure rates five stars and is used as a standard for comparing the FRP games that I review. I look for a game in which I become involved in the character instead of looking at the computer screen. I like to find myself looking through my character's eyes; the information on the computer only aids my imagination. An FRP game with computer graphics is preferred, but is not necessary if the program gives an adequate description of what I see.

One of the qualities of Adventure is that you get a complete description the first time you visit a room, but on successive visits, you get a brief sentence "you are in the ... room." The game must be challenging mentally with various puzzles to solve, or challenging to my dexterity, where speed and quick reflexes are important.

I don't like to have my choice of actions limited to essentials such as direction and fight or run. I like to worry about the oil supply in my lantern, whether I'm thirsty or hungry, and when I have to heed nature's call. (How many FRP games have this feature?)

A variety of weapons with noticeable differences in effects and various potions and spells are essential to making the game believable. Also, the game must increase in difficulty as my character grows stronger. Usually this is done by having the character descend into the dungeon, where he meets more deadly monsters and other evils.

A good FRP or adventure game takes place in a complex world. There must be lots of interesting items that I can use, even if I don't know how to use them yet. The places must be interesting to visit with enough diversity so I can remember the dungeon or ground world without having to draw a map.

Dungeon of Death ****

Dungeon of Death from Instant Software includes three programs: title, dnd help, and dnd. Title displays a screen with the title and instructions on how to load the dnd help program, which in turn offers the instructions to dnd. The dnd help program is almost the same as the instruction booklet. The only useful thing in it is the option to display all twelve levels of the dungeon, which is useful in finding exits and stairways. Dnd is the actual *Dungeon of Death* game.

The instructions are very enjoyable to read, written informatively, without any non-essential comments, and extremely funny. Charts are included to tell you how effective magic attacks will be. The game itself kept my attention with amusing user comments and simple graphic displays. There are several options when entering combat, opening chests, or using magic. I found the game very relaxing, and was surprised when unexpected things happened.

Pagoda ****

Pagoda from the Alphoid Co. has excellent documentation, graphics, and user options, and is extremely challenging. The instructions themselves require that you list the command options, of which there are many. They are written in such a manner that they draw you into the history of the Pagoda, and of course, lure you into playing the game.

Pagoda is extremely challenging to play. Many things can happen to you, like a broken ankle, which can severely hamper your movement. I recommend this game highly, with the warning that both the instructions and the game will consume a great deal of time.

Explore **

The *Explore* package from Channel Data Systems contains five "stories." The first one, Self Tutor Practice, is well written, and fun to play, although it is only a demonstration game in which the computer tells you what to do. Of course, you can try other things too.

Mall Mixup is the second "story." In it you are placed on the Mall at Washington, DC. The object is to find the national treasures (which have been put in the wrong places by the curator) and put them back to into their appropriate buildings. I found this rather dull. Tank Battle is more

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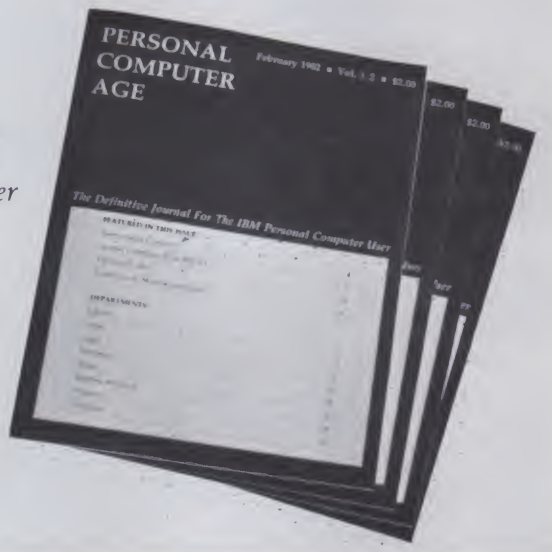

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enjoyable, mainly because the game is played on a hexagonal grid, which makes it easier to visualize.

Spelunker Beware is similar to Adventure. In it you must explore a cave that contains dangers, magic, and traps. The program is very large and a bit slow. Haunted Castle is the largest game, which caused it to limit your vocabulary. For example, north becomes N. This is easy to adjust to, especially if you have been using the shorthand form of the commands anyway.

Dunjonquest ***

The Automated simulations Dunjonquest games that I have played are *Morloc's Tower*, *Temple of Apshai*, and *The Datestones of Ryn*. All the games are similar in their introduction and setup of

Figure 2. The Same Benchmark Program Done Several Ways. The same program is written for each of the languages reviewed in the column. These examples show the writing styles for each language.

Oxford Integer Basic

```
10  @SUBS 10000:@STRINGS=25000,30000
20  @MEM CO=11000 DA=20000 PT=23000 ST=23500
30  SCHED200
40  SC=32768:B=0:T=TI
50  FORA=0TO255
60  AD=SC:GOSUB120
70  AD=AD+256:GOSUB120
80  AD=AD+256:GOSUB120
90  AD=AD+256:GOSUB120
100  B=B+1:NEXTA
105  T2=TI-T:T3=T2/60
110  PRINT"TIME":PRINTT3:END
120  FORP=0TO255
130  C=P+B:IFC>255THENC=C-256
140  POKEAD+P,C
150  NEXTP
160  RETURN
200  TI=TI+1
210  RTI
```

PET/CBM Basic

```
10 REM UNFAIR BENCHMARK
20 SC=32768:B=0:T=TI
30 FORA=0TO255
40 AD=SC:GOSUB100
50 AD=AD+256:GOSUB100
60 AD=AD+256:GOSUB100
70 AD=AD+256:GOSUB100
80 B=B+1:NEXTA
90 PRINT"TIME:"(TI-T)/60"SEC":END
100 REM DO ONE PAGE
110 FORP=0TO255
120 C=P+B:IFC>255THENC=C-256
130 POKEAD+P,C
140 NEXTP
150 RETURN
```

KMMM Pascal

```
(* UNFAIR BENCHMARK *)

CONST SCREEN=$8000;
VAR   ADDR,ACOUNT,BCOUNT : INTEGER;
      TIME,TIME1,TIME2 : REAL;

FUNCTION FINDTIME : REAL;

   VAR LOOK1,LOOK2,LOOK3 : INTEGER;
       SUM : REAL;
   BEGIN LOOK1 := ORD(MEM[141]);
         LOOK2 := ORD(MEM[142]);
         LOOK3 := ORD(MEM[143]);
         SUM := 256 * LOOK1 + LOOK2;
         SUM := 256 * SUM + LOOK3;
         FINDTIME := SUM
   END;

PROCEDURE DOAPAGE;

   VAR PCOUNT,CVAL : INTEGER;
   BEGIN FOR PCOUNT := 0 TO 255
         DO BEGIN
         CVAL := PCOUNT + ACOUNT;
         IF CVAL > 255 THEN CVAL := CVAL - 256;
         MEM[ADDR + PCOUNT] := CHR(CVAL)
        END
   END;


   (* MAIN CODE *)

   BEGIN
      BCOUNT := 0;
      TIME1 := FINDTIME;
      FOR ACOUNT := 0 TO 255
             DO BEGIN
             ADDR := SCREEN; DOAPAGE;
             ADDR := ADDR + 256; DOAPAGE;
             ADDR := ADDR + 256; DOAPAGE;
             ADDR := ADDR + 256; DOAPAGE;
             BCOUNT := BCOUNT + 1
          END;
      TIME2 := FINDTIME;
      TIME := (TIME2 - TIME1) / 60;
      WRITELN('TIME:',TIME,'SEC')
   END.
```

Comal

```
0010 // UNFAIR BENCHMARK DONE IN COMAL //
0020 // MAIN PROGRAM //
0030 //*
0040 SCREEN:=32768; BCOUNT:=0
0050 CLOCK:=141; TIME1:=FINDTIME(CLOCK)
0060 FOR ACOUNT:=0 TO 255 DO
0070   ADDR:=SCREEN
0080   EXEC DOAPAGE
0090   ADDR:=ADDR+256
0100   EXEC DOAPAGE
0110   ADDR:=ADDR+256
0120   EXEC DOAPAGE
0130   ADDR:=ADDR+256
0140   EXEC DOAPAGE
0150   BCOUNT:+1
0160 NEXT ACOUNT
0170 TIME2:=FINDTIME(CLOCK)
0180 TIME3:=(TIME2-TIME1)/60
0190 PRINT "TIME:",TIME3,"SEC"
0200 //*
0210 PROC FINDTIME(X)
0220   SUM:=PEEK(X)*256*256+PEEK(X+1)*256+PEEK(X+2)
0230   FINDTIME:=SUM
0240 ENDPROC FINDTIME
0250 //
0260 PROC DOAPAGE
0270   FOR PCOUNT:=0 TO 255 DO
0280     CVAL:=PCOUNT+ACOUNT
0290     IF CVAL>255 THEN CVAL:=CVAL-256
0300     POKE ADDR+PCOUNT,CVAL
0310   NEXT PCOUNT
0320 ENDPROC DOAPAGE
0330 //
```

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CIRCLE 243 ON READER SERVICE CARD

character, graphics, and combat with various monsters.

The introduction is well written, allowing you to choose your own character's makeup or have the computer create one for you. Like the actual FRP games played without computers, your character has intelligence, intuition, ego, strength, constitution, and dexterity. In The *Temple of Apshai*, you have several gold pieces with which to barter for equipment and food. (I laughed during the entire bargaining process with the innkeeper.)

The instructions are well written with tables to show you the command list and descriptions of the importance of intelligence, fatigue, strength, and other attributes. The graphics are fairly well done using the quarter square blocks to draw the walls and your position on the screen. Your character's direction is shown, which is useful in moving and looking at walls. The upper right of the screen displays a constant update of your character and combat status.

Although the Dunjonquest software is detailed, it does not play smoothly. I found command entry to be slow and confusing. I could type a sequence of commands, and then have to repeat all of it before entering a new command. The game becomes routine after a while: enter a room, fight the monsters, check out the treasures, check the walls for hidden doors, go to the next room. The graphics don't vary enough to keep my attention. The character tires (and dies), easily and the various combat options don't really make much difference.

Micro Warrior *****

Micro Warrior from Instant Software is excellent—fun, challenging, suspenseful. The entire program is written in machine language (and it works on any PET/CBM except 8032), so it works fast and well. The graphics are updated on the screen instantly, and combat with the monsters is quick and dangerous.

Furthermore, your selection of weapons has an important effect on the damage you can inflict. You also have a choice of several cleric and magic spells which can be used to cure yourself, fight, or improve your own abilities. The instructions are concise and easy to read. This is the best FRP game that incorporates real time graphic displays and action I have ever seen.

SwordQuest **

SwordQuest from Fantasy Game Software includes graphics and sound (if you have a speaker connected to CB2), and takes place in real time. Written in Basic, *SwordQuest* takes time to update a monster's movement. The game starts at its hardest level. Fortunately, the instructions tell you how to change the difficulty level

Figure 2., continued...

Forth

```
: CLEAR 32 32768 DUP 1024 + SWAP DO DUP I C! LOOP DROP ;
: DOAPAGE DUP 256 + SWAP DO 1 + DUP I C! LOOP DROP ;
: 2DUP OVER OVER ;
: DOSCREEN 32768 256 - 4 0 DO 256 + 2DUP DOAPAGE LOOP DROP ;
: DOALL 255 0 DO I DOSCREEN DROP LOOP ;
: CLOCK 141 C@ 142 C@ 143 C@ ;
: DOBENCH CLOCK DOALL CLOCK CLEAR . . . . . ;
DOBENCH
```

RPL

```
20 CLOCK &
30 DOALL &
40 CLOCK &
50 CLEAR &
60 STR$ PRINT " " PRINT
70 STR$ PRINT " " PRINT
80 STR$ PRINT "  " PRINT
90 STR$ PRINT " " PRINT
100 STR$ PRINT " " PRINT
110 STR$ PRINT " " PRINT
120 STOP
130 CLOCK: 141 PEEK 142 PEEK 143 PEEK RETURN
140 CLEAR: 32 32768 # 1024 + %
150 FOR # FN POKE NEXT . RETURN
160 DOALL: 255 0 FOR FN DOSCREEN & . NEXT RETURN
170 DOSCREEN: 32768 256 - 4 0 FOR 256
180 + ; ; DOAPAGE & NEXT . RETURN
190 DOAPAGE: # 256 + % FOR 1 +
200 # FN POKE NEXT .. RETURN
```

Vigil

```
1 SYS826
2 E
5 REMBENCHMARK
10 REM BENCHMARK IN VIGIL
20 REM GET TIME
30 RD141
40 RE142
50 RF143
60 LETP0
70 LET00
80 LETK0
90 LETN1
100 REM SET UP MACH LANG
110 POKE20000,"A9008D008060"
120 E
130 REM MAIN LOOP
140 LETM128
150 KM20004
160 GOSUB400
170 IM1
180 KM20004
190 GOSUB400
200 IM1
210 KM20004
220 GOSUB400
230 IM1
240 KM20004
250 GOSUB400
260 I01
270 +KN
280 #Z0
290 GOTO140
300 RG141
310 RH142
320 RI143
330 E
340 W
350 STOP
390 REM DO ONE PAGE TO SCREEN
400 LETJ0
410 =P0
420 KP20001
430 KJ20003
440 USR20000
450 IP1
460 +JN
470 #Z0
480 GOTO420
490 RETURN
1000 REM VIGIL REGISTER USAGE
1010 REM D E F INITIAL PET CLOCK
1020 REM G H I FINAL PET CLOCK
1030 REM P VALUE POKED TO SCREEN
1040 REM O START VALUE FOR P
1050 REM J DOAPAGE COUNTER
1060 REM K MAIN LOOP COUNTER
1070 REM MACHINE LANGUAGE IS:
1080 REM
1090 REM LDA #CHAR
1100 REM STA SCRADDR
1110 REM RTS
1120 REM
1130 REM M IS HI BYTE IN SCRADDR
1140 REM N IS THE INTEGER 1
```

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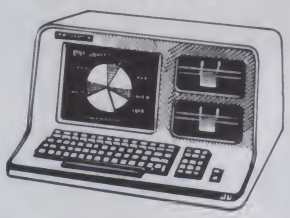

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PET/VIC, continued...

and the number of monsters. The game is similar to Chase, an old *Creative Computing* game in which electronic computers chased you around a maze and tried to electrocute you. At least the graphics keep my interest.

Death Star ***

This game is more fun than *Sword-Quest*, because you get to blast robots, and they get to blast you. It takes some skill, because you can hide behind walls, shoot rapid-fire, and rescue a princess, who is very grateful if you make it to the escape hatch. □

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Figure 2., continued...

6502 Assembler

```
10 REM DRIVER BASIC PROGRAM FOR BAD BENCHMARK
20 REM DONE IN ASSEMBLY LANGUAGE
30 REM NOTE - MUST HAVE OBJECT CODE LOADED AT $7000
40 AD=7*4096:REM SYS ADDRESS
50 DEF FNJ(X)=PEEK(X+2)+256*(PEEK(X+1)+256*PEEK(X))
60 P1=AD+99 :REM FIRST TIME SAVED HERE
70 P2=P1+3 :REM SECOND TIME HERE
80 REM AT LAST WE DO IT
90 SYSAD
100 PRINT(FNJ(P2)-FNJ(P1))/60
```

```
                0010;THIS IS THE BAD BENCHMARK DONE IN ASSEMBLY LANGUAGE
                0020;USING THE SKYLES MACROTEA
                0030;COPYRIGHT 1982 BY GREGORY YOB
                0040;
                0050;VARIOUS DEFINITIONS
                0060;
                0070 .CE ;CONTINUE ASSEMBLY IF ERRORS SEEN
                0080 .OS ;LOAD CODE INTO RAM ON ASSEMBLY
                0090SCREEN .DI $8000 ;START OF SCREEN
                0100PTR .DI $6E
                0110TIME .DI $8D ;PET TIME CLOCK
                0120 .BA $7000
7000-AD8D00     0130START LDA TIME ;READ THE TIME BYTES
7003-8D6370     0140 STA TIME1
7006-AD8E00     0150 LDA TIME+1
7009-8D6470     0160 STA TIME1+1
700C-AD8F00     0170 LDA TIME+2
700F-8D6570     0180 STA TIME1+2 ;AND SAVE IN TIME1
                0190;
                0200;NOW FOR THE MAIN LOOP
                0210;
7012-A200       0220 LDX #0
7014-A900       0230MLOOP LDA #L,SCREEN ;SET POINTER
7016-856E       0240 STA *PTR
7018-A980       0250 LDA #H,SCREEN
701A-856F       0260 STA *PTR+1
701C-204D70     0270 JSR SLOOP ;INNER LOOP
701F-A981       0280 LDA #H,SCREEN+$100
7021-856F       0290 STA *PTR+1
7023-204D70     0300 JSR SLOOP
7026-A982       0310 LDA #H,SCREEN+$200
7028-856F       0320 STA *PTR+1
702A-204D70     0330 JSR SLOOP
702D-A983       0340 LDA #H,SCREEN+$300
702F-856F       0350 STA *PTR+1
7031-204D70     0360 JSR SLOOP
7034-EE6170     0370 INC CHAR ;GO TO NEXT STARTING CHARACTER
7037-E8         0380 INX
7038-D0DA       0390 BNE MLOOP ;END OF MAIN LOOP
703A-AD8D00     0400 LDA TIME ;READ THE TIME BYTES
703D-8D6670     0410 STA TIME2
7040-AD8E00     0420 LDA TIME+1
7043-8D6770     0430 STA TIME2+1
7046-AD8F00     0440 LDA TIME+2
7049-8D6870     0450 STA TIME2+2 ;AND SAVE IN TIME2
704C-60         0460 RTS ;END OF CODE IF CALLED BY SYS
                0470;
                0480; INNER LOOP TO DO 256 CHARACTERS
                0490;
704D-AD6170     0500SLOOP LDA CHAR ;GET START CHAR
7050-8D6270     0510 STA CHAR1
7053-A000       0520 LDY #0
7055-916E       0530SLOOP1 STA (PTR),Y ;PRINT ON SCREEN
7057-EE6270     0540 INC CHAR1
705A-AD6270     0550 LDA CHAR1
705D-C8         0560 INY
705E-D0F5       0570 BNE SLOOP1
7060-60         0580 RTS
                0590;
                0600;STORAGE DEFINITIONS
                0610;
705E-00         0620CHAR .BY 0
705F-00         0630CHAR1 .BY 0
7060-000000     0640TIME1 .BY 0 0 0
7063-000000     0650TIME2 .BY 0 0 0 ;TIMES FOR RECOVERY IN BASIC
                0660 .EN

SCREEN=8000          PTR=006E
TIME=008D            START=7000
MLOOP=7014           SLOOP=704D
SLOOP1=7055          CHAR=7061
CHAR1=7062           TIME1=7063
TIME2=7066
//0000,7066,7066
```

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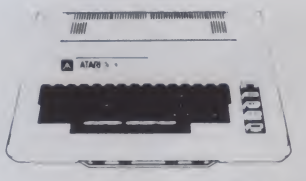

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CIRCLE 149 ON READER SERVICE CARD

rings...trs-80 strings...trs-8

Stephen B. Gray

Elevated at 45 degrees from the horizontal, the TRS-80 cannon shoots down seven targets: two printers, a print utility, two games and a personal finance aid from Acorn, and a short one that may keep you guessing a while. (Just in case you are a new reader, this is the 45th column.)

Printers

Radio Shack offers a variety of printers for the TRS-80, and many more are available from other sources. Lowest in cost are the dot-matrix printers, such as Radio Shack's Line Printer II (June 1980, p. 170), first seen at $970 in the RSC-3 catalog of 1979, and last seen at $799 in the RSC-5 catalog of 1981.

Line Printer II, which was the Centronics 730 with a Radio Shack label, was limited in features. It printed upper and lower case letters, 50 a second, in a 7 x 7 dot-matrix format with no descenders, which wasn't all that easy to read. It could also print expanded (wide) characters under software control (Figure 1). That's all it could do, but it operated in both friction-feed and pin-feed modes, and was Radio Shack's cheapest printer using ordinary paper (there used to be several inexpensive printers using aluminum-coated paper less than 5 inches wide). Although not intended for heavy, constant use in a business environment, Line Printer II was (and is) a real workhorse for limited applications, and I have been using mine to print out program LISTings, in uppercase letters, for this column since the May 1980 issue.

In the latest catalog I have on hand, RSC-7, the lowest-price dot-matrix printer is Line Printer VII, at $399. It is similar to Line Printer II, with no descenders for its regular and expanded characters, and prints 30 characters a second. However, it has a bit-image mode that allows printing high-density graphic information, such as from a high-resolution Color Computer display, at 3780 dots per square inch.

Line Printer VIII

For twice as much money, you can get a Radio Shack dot-matrix printer with a fascinating variety of features. Line Printer VIII (Figure 2), at $799, offers proportional spacing, elongated or condensed characters, underlining, superscripts, subscripts, backspacing, 32 special and "international characters" (letters with accent marks) for European use, 64 Japanese katakana characters, and 30 graphics characters (Figure 3). The printer has a word-processing mode, for high-quality printing, using a variable dot-matrix format, with up to 9 x 23 dots; it also has a fast printout, in data processing mode, using an 8 x 9 matrix.

```
Line Printer II: Normal.
abcdefghijklmnopqrstuvwx
FAT  LETTERS.
```

Figure 1. Examples of printing with Line Printer II, showing the lack of descenders in both regular and expanded characters.

Figure 2. Line Printer VIII is a moderately priced dot-matrix printer with a very useful range of features.

```
This is normal printing.
Proportional spacing is like this.
Elongated.
Condensed printing is squeezed.
```

Figure 3. The character set of Line Printer VIII includes Roman letters in various shapes, Japanese characters, and graphics blocks.

II + II =

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CIRCLE 223 ON READER SERVICE CARD

There is a catch, though. Those fine features aren't all that easy to use. What is worse, the manual makes them seem even more complicated than they really are, having been written more for an engineer than for a businessman or a hobbyist.

The first dozen pages, all about setting up Line Printer VIII, are straightforward and fairly simple. Then the manual gets into operating the printer, and within a page or two manages to confuse most readers with some rather obtuse sentences and long paragraphs about control codes, character font selection, a mystifying page on line feed, and then some really mysterious esoterica about positioning, proportional spacing and such. A computer user buys what he thinks is a fairly simple printer, and then finds out, from the manual, that he has something about as simple to learn to use as a Learjet.

But wait, there seems to be some hope. Page 35 is the beginning of a section on Programming Information, and for a moment you think, "Here's where they make it simple for those of us who didn't major in Computer Science." Wrong again! Fourteen examples are given. Not "printing examples," but "programming examples," which should be a clue that there is no simple way to use Line Printer VIII. Turns out you have to use LPRINT and CHR$ to do anything other than simple, straightforward printing. However, one of the most maddening things about this maddening manual is that there is no simple chart of the CHR$ commands. You have to figure out which is which from the programming examples. That is, unless you realized that the decimal codes cleverly concealed in the Control-Code Summary chart back on page 24 are the CHR$ codes to use.

Okay, once you figure out the proper CHR$ codes, you realize they have to be used *each and every time* you want to switch from one mode to another. To print a simple chemical formula involving five compounds using subscripted numbers and superscripted plus and minus signs, takes 35 CHR$ codes. To make things worse, the whole thing is in Basic, as are all the "programming examples." Suppose you want to use some of these fascinating features in *Scripsit*. There isn't one single mention of *Scripsit* in the entire manual. If you have high blood pressure and no engineering degree or electromechanical inclination, don't open this manual; it is the most complicated I have yet seen come out of Fort Worth. Apparently they don't believe in trying out their manuals on ordinary folk before publication.

To start elongated printing, you have to use

CHR$(27); CHR$(14)

and to go back to normal printing, use

CHR$(27); CHR$(15)

while to start proportional spacing you need

CHR$(27); CHR$(17)

and to go to condensed printing requires

CHR$(27); CHR$(20)

and then, to get back to ordinary printing

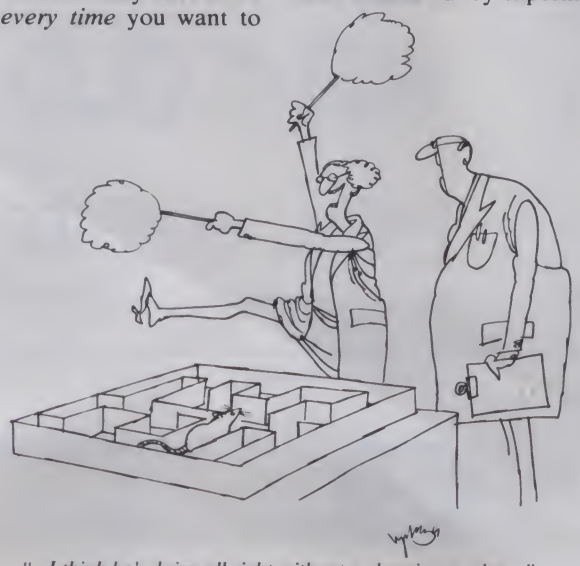
CHR$(27); CHR$(19).

To print the chemical formula for water, H_20, takes

LPRINT"H"; CHR$(27); CHR$(28); "2"; CHR$(27); CHR$(30);"0"

with the CHR$(28) required for a "half forward line space," meaning moving the paper up half a space, and the CHR$(30) required for a "half reverse line space," which moves the paper back down the half-space. Got all that? If you do, and are willing to go through it all, and in Basic yet, you're a better man than I am, Gunga Din.

Yes, some of the features—but only a few—can be used in Scripsit, which you have to find out by experimenting.



"...I think he's doing all right without a cheering section..."

However, as usually happens when Radio Shack omits an important feature, such as not telling you how to use a printer with *Scripsit*, an independent, outside company offers help.

Scriplus To The Rescue

One of the most interesting and useful print utility programs available is from Powersoft (11500 Stemmons Expressway, Dallas, TX 75229): *Scriplus 3.0* ($39.95 plus $5 for shipping and handling).

Scriplus 3.0 is "a modification to *Scripsit* that lets you take advantage of the special functions, features, and print formats of your printer while your document is being printed," as the Powersoft ad puts it. Although designed specifically for Epson printers, it works with any printer that accepts CHR$ commands for control.

Scriplus permanently modifies the disk version of *Scripsit* to allow you to: send commands to the printer to activate special formats and functions; stop the printer so you can insert text, align forms, or change print-heads; optionally select line feed after carriage return; list alphabetically a disk directory from within *Scriplus* and fetch, chain or kill any file right from the display; and edit inserted text before resuming printing. *Scriplus* modifies all versions of *Scripsit* for Model I or III machines, allows you to use Model I *Scripsit* on a Model III, and works with all well-known Model I or III operating systems, including LDOS, DOSPLUS, NEWDOS, TRSDOS, and DoublDOS.

How Scriplus Works

The way *Scriplus* works is simplicity itself. You just use the control codes, without CHR$, in *Scripsit*. For instance, to print elongated characters, just put

27,14,

ahead of the words to be stretched. And if you want to go back to normal printing in the same text, just put

27,15,

in front of the part of the text to be printed normally. Characters that don't appear on the keyboard, such as brackets, can be printed out by using their ASCII equivalents in the control code lines. A question mark stops the printer so you can change printwheels, insert text, or position the paper for forms alignment. You can read the disk directory from within *Scriplus* by pressing BREAK and then typing a colon followed by the drive number.

These are only a few of the many features offered by *Scriplus*, which are described in rather small print, and not always written clearly enough for the uninitiated (but most beginners aren't ready for *Scriplus* anyway), in a little 14-page manual that often goes into detail, with a variety of examples.

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Except for Quest, itself unique among Adventure games, Adventures are non-graphic. Adventures are more like a novel than a comic book or arcade game. It is like reading a particular exciting book where you are the main character.

All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC.

TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players—This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players—This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

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All adventures are $14.95 on tape except Earthquake and Haunted House which are $9.95. Disk versions are available on OSI and TRS-80 Color for $2.00 additional.

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CIRCLE 101 ON READER SERVICE CARD

Figure 4. Smith-Corona's TP-1 is the first daisywheel printer to sell for under $900; slower speed is the secret.

Figure 5. Smith-Corona's one-time film ribbon provides letter-quality printing on the TP-1 daisywheel printer.

```
This is a sample of how the
Smith-Corona TP-1 prints with
a film ribbon. It costs more,
but the quality is high.
```

Daisywheel Printers

The most expensive printer offered by Radio Shack in catalog RSC-7 is the $1960 Daisywheel II, which at 43 characters per second prints slower than the two top dot-matrix printers: Line Printer V (160 cps) or VI (100 cps). But it is a "letter-quality" printer, used for important documents. It is slower because a daisywheel has to spin around to the next character, which takes longer than pushing a couple of dot-matrix pins a short distance out from a printhead.

Even at 43 cps, a daisywheel printer requires rather precise mechanisms. But if you slow it down, you can use less precise—and therefore less expensive—mechanisms, and that's just what Smith-Corona has done.

Smith-Corona's TP-1 Daisywheel

You may have noticed ads in these pages for a low-cost daisywheel printer. Smith-Corona advertises the TP-1 (Figure 4) for "under $900"; the suggested list price is $895. A dealer can sell it at any price he chooses; some offer the TP-1 at $895, while others sell it for less. Micro-Printer Marketing (MPM), which also advertises in these pages, sells the TP-1 for $845. (Yes, they did advertise it at first for $799, but that was a mistake; "crossed wires," they said.)

The TP-1 prints 12 characters per second, and does it beautifully (Figure 5). If you are not in a hurry, you may find this daisywheel printer is just right. You can get it in two models, like most typewriters: 10 characters per inch (six different printwheels are available); and 12 characters per inch (five printwheels). MPM sells the printwheels at $4.95 each.

Smith-Corona makes three ribbon cassettes that snap in and out very quickly. MPM offers Smith-Corona's "one-time film" ribbon, for the highest quality of print, at $2.95; it's good for about 57,000 characters (Figure 5). For $3.45, MPM sells the nylon-fabric ribbon, which provides good but not top-quality printing, for about 250,000 characters. That's about 5.18 cents per thousand high-quality characters, and 1.38 cents per thousand low-cost characters. Smith-Corona also has a "multi-strike Mylar" ribbon, not offered by MPM, which overlaps characters on the ribbon, for a somewhat lower quality of printing than with one-time film, and for about 240,000 characters.

In addition to the slower speed, another factor that keeps down the price of the TP-1 is the print mechanism, which is the same as on the Smith-Corona electronic typewriters—the Typetronic office model and Ultrasonic portable—and thus didn't require any expensive R&D time. Also, there's no end-of-paper switch, such as you'll find on the Line Printer VIII. If you want to print on cut sheets of paper rather than use continuous forms, you must do something to defeat the end-of-paper switch, such as back up the cut sheets with a long piece of continuous-form paper, to keep that switch from operating. This is no problem with the TP-1.

To use the TP-1 with *Scripsit*, you need to know that the TP-1, when it receives a carriage-return (CR) signal, does a CR and a line feed (LF). But it will not space up the paper if it receives a LF preceded by a CR. Thus, to double-space, the TP-1 must receive a CR+LF, then a LF.

To help keep down the cost, the TP-1 has only a couple of software-controlled printing features: boldface (by back-spacing and printing each letter a second time); setting margins and tabs; and underscoring.

The TP-1's character set provides 128 ASCII characters, 88 of them printable, but no less-than or greater-than signs. A top-of-form switch is provided, as are serial and parallel interfaces.

The TP-1 manual is a model of simplicity, and can be read and understood by almost any teenager, except perhaps for a couple of semi-technical pages at the end.

Three From Acorn

Let's take a look at three programs for the TRS-80 Models I and III from Acorn Software Products, Inc. (634 N. Carolina Ave., S.E., Washington, DC 20003). They are available at your local computer store or, with an additional $2 for shipping and handling, from Acorn. First, two games, *Astroball* ($19.95 on 16K tape or disk) and *Lost Colony* ($29.95 on 16K tape or 32K disk); then an expense-monitor, *Money Manager* ($39.95 on 32K (minimum) disk).

Astroball

Astroball is a space-age pinball game, with many underlying features in common with Acorn's *Pinball*, but with many more moving targets. The ball speed is faster, and Acorn claims the game "on the fastest of the five skill levels, is quite difficult to control."

To start, you hold down the spacebar. The ball moves up and down in the lowest inch of the ball-chute, at the bottom right of the display (Figure 6). If you release the spacebar when the ball is at the top, it will move slowly into the game area. But if you release the spacebar when the ball is at the bottom, the ball moves faster, just like an arcade game, where the further back you pull the plunger, the faster the ball goes. You get five balls per game.

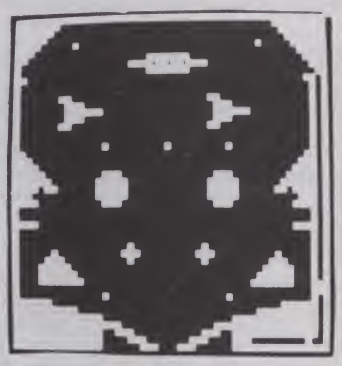

Figure 6. Astroball display, showing the ball-chute along the right edge, a pair of flippers at the bottom, and 18 targets.

The up-arrow and right-arrow control flippers at the bottom of the game area. You press the arrow keys to flip the ball back into the game, but there is just enough room between the flippers, of course, for the ball to drop between them and end its play.

As the ball flies around the screen, it scores points by hitting various objects, such as Space Ships, Flying Saucers, Asteroids, Meteors, and Pulsars. Two of the objects are Black Holes; hit one of them and the ball may disappear if the nearby Pulsar is not lit and therefore hasn't enough gravitational pull to yank the ball back out of the Black Hole. There

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are some special scoring features, such as earning an extra ball if you manage to explode any five of the seven Meteors with one ball.

Sound effects are included: you get a plunk-plunk sound as the ball bounces around the game area, and various witchoo-witchoo, wowee and beeoop sounds as the ball hits targets. The little eight-page manual says "a good player should score about 30,000" points. Well, I didn't get near that, but the game is addicting enough that I didn't want to try for the 30,000, or for the 80,000 an excellent player is supposed to be able to score, because I could get hooked, and there were two more Acorn programs to check out. One of the hooks of this game is that a fair amount of luck is involved, because the path of the ball is beyond your control—and depends only on how far back you pulled the "plunger"— until it gets within range of the flippers. You keep telling yourself luck will be entirely on your side in the *next* game, and luck, combined with your ever-increasing skill as you play more and more, will give you a much higher score than ever before.

Lost Colony

The Acorn ads describe the game thusly: "You are the Economic Manager of the world's first space colony. The next support ship from Earth isn't due for another 15 years and you have instructions either to make things go better or get out of office in shame. You must assure the survival of this struggling space colony—it's all up to you. You'll be presented with the human, natural and industrial resources of the planet. You must allocate labor, explore new territories, decide on production quotas, determine pay scales and taxes for the most productivity—you're armed with maps and charts. 10 levels of difficulty."

The 23-page booklet goes into a great amount of detail, and the first page notes this is "a complex simulation. It is suggested that you read this documentation carefully before attempting serious play." As you play, you are presented with chart reports involving five industries: farm, minerals, energy, manufacturing, and transportation. You decide who works where, what is manufactured, how many factories are built, what the standard of living is, how much capital equipment, distribution of consumer goods, what is stockpiled, what tax rates are changed, when to explore new territories, how to settle new territories, etc. You get a year-end report when you have done everything, and then you can begin a new year, in which you try to do better. But if the standard of living isn't up to the workers' expectations, they will strike or throw you out of office. How's that for a challenge?

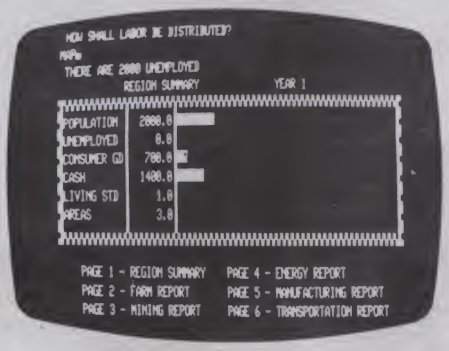

Figure 7. One of the reports generated by Lost Colony, with a bar graph showing several of the resources.

The game is almost entirely based on displayed reports (Figure 7) which show, in numbers and bar graphs, how you have allocated resources. The manual provides minute detail on how to play the game, and also provides a couple of pages of hints, such as "Explore the continent and settle only the lush new areas," "Plan on growing more food than you need," and "Watch the bar graphs in the various reports to get an idea of how developments in one industry affect the others."

If you are into resource management simulation, the space age features of *Lost Colony* can be quite intriguing; similar simulations may well be in actual use 100 years from now, or whenever space colonies become practical. The game isn't all reports; there is a small, fascinating map of the continent on "Warren's World," the name bestowed by author David Feitelberg on the colonized small planet, which he may have named after Jim Warren, one of the personal computer pioneers. The map is divided into 45 areas; at any stage of the game you can call up the map and ask for a display of either the settled areas or the resource (raw materials) sites.

Money Manager

This is a menu-driven personal finance management program that allows you to define your own categories of expense (up to 99 of them) and has a built-in category for tax-deductible items. *Money Manager* permits storing data in as many as 100 checkbook entries per month (250 with a 48K system, but you will need more than one disk drive; each check-writing year has its own diskette). Automatic withdrawals can be specified, and lump payments (such as often occur with credit cards) can be broken down into several categories. The program was developed for output to an 80-column lineprinter, and allows formatted printouts by category and time period. (If you use a printer with less than 80 columns, you must change printer formatting in the program.)

If you are using a TRS-80 Model III, you must use the Convert utility to make this Model I disk compatible with your machine. Then with a RUN"MONEY" the checkbook program loads into memory and executes. When you press ENTER,

Figure 8. These 15 options are displayed in the program menu for Money Manager.

```
(A) ADD NEW ENTRIES TO THE FILE
(B) DELETE/MODIFY CHECKBOOK ENTRY
(C) REVIEW ANY CHECKBOOK ENTRY
(D) CHANGE/DISPLAY BALANCE
(E) PRINT ALL CATEGORIZED ENTRIES
(F) RECONCILE CHECKBOOK
(G) REVIEW COMPLETE CHECKBOOK FILE
(H) REVIEW CHECKBOOK FILE BY MONTH
(I) REVIEW CATEGORIZED ENTRIES
(J) REVIEW DEPOSITS
(K) REVIEW BANK CHARGES
(L) REVIEW MISCELLANEOUS WITHDRAWALS
(M) REVIEW OUTSTANDING CHECKS
(N) MODIFY/LIST CATEGORIES
(O) DISPLAY CATEGORY/MONTH MATRIX
```

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the first menu (Figure 8) is displayed.

Although option A may seem the first to call up, you must first assign a list of categories, using option N. "The ability to establish categories reflecting your own needs and goals is one of the features that makes *Money Manager* so valuable," says the 18-page manual, adding "We can't decide how much you should spend on what—this isn't a budget-making program—but once you have decided, you can use the categories to monitor how well you are doing. The printing capability makes it possible to know where your money is going as well as whether a category needs breaking down further or eliminating."

The manual notes that perhaps you don't want to begin by making out a budget. No problem; just plan and enter your categories, and the program will let you monitor your expenditures. "If you want to use your actual living expenditures as a basis for planning later, you'll find yourself in possession of much valuable information about your lifestyle."

So first you assign categories. The program reserves the first category for tax-deductible items, but from then on, you're on your own, and can add or delete categories, or change their names, or display or print them. So you set up categories for rent, phone, utilities, entertainment, transportation, etc.

Then you get into option A, adding new entries. This is where the bulk of the work is, adding newly written checkbook entries and deposits to the file. The first time around, the program asks how many disk drives you are using, what the check-writing year number is, and what your checkbook balance is. The manual notes that "The maximum balance allowed in the TRS-80 version is $999,999.99," which may be a little low for some readers, but which should be adequate for the majority.

You enter the check number, date, description, amount, category, and whether the item is tax-deductible. Then you get a new balance display, and the program asks if the information is correct and if you have any more entries.

Other options permit you to delete or modify a checkbook entry, review any checkbook entry, display or change the balance, print all categorized entries, and so on down the line of over a dozen options.

In option F, for balancing your checkbook, all outstanding checks are displayed. You indicate the cancelled checks, and if the program-generated balance matches the balance printed on your bank statement, you can enter the cancelled checks into the file. If it doesn't, you go back to the main menu to start looking for the error.

If you are willing to spend the time entering all your expenditures and deposits into *Money Manager*, you may be quite surprised to find out where your money is really going. And then, even if you are not on a budget, you may decide to spend a little less here, or a little more there. At this point in the economy, can you afford *not* to know where your money is going?

Short Program #33: Guessing Game

Can you predict what sort of pattern this graphics program will generate?

```
100 CLS
110 X=RND(45)
120 Y=RND(X)
130 SET(X,Y)
140 GOTO 110
```

The answer is very simple, but you may have to RUN the program first, and then figure out why the pattern looks the way it does. Add

```
135 RESET(X+1,Y+1)
```

to turn it into a constantly-changing pattern. □

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iews...book re

Steve Gray, et al.

Silent Witness, by Ed Yourdon. Yourdon Press, New York, NY. 177 pages hardcover, $12.95.

Your wife is a hypochondriac and a terrible nag. She has just entered the hospital (again) for a series of tests. The doctor confides to you that there is really nothing wrong except that she wants some attention. He also informs you that he would like an advance payment against his bill. You write out a check on the spot but realize that when you receive the hospital bill it will drive you into personal bankruptcy. In utter despair you begin wandering the streets of New York during one of the worst blizzards ever to hit the city. During your wandering you stumble upon a scene that has all the earmarks of a gangland execution. Near one of four bodies you spot a suitcase and decide to look inside. Lo and behold, $3 million!

After some soul searching, you decide to erase your old identity and establish a new one. Erase is the operative word. For while it is easy enough to change your physical appearance, your big job is to erase all trace of your new existence from any computer systems which may give others a clue to tracking you down.

The guy in the paragraph above isn't the hero of *Silent Witness* and we have come in half-way through the novel anyway. What's the point? The point is that Ed Yourdon has written an eminently believable and all-too-realistic story of life in these computerized times. In the first half of the book he describes a completely plausible scheme for bilking $3 million out of the electronic funds transfer system used by every multiple branch bank in the country. Some inside knowledge, a few lines of code, and a few unknowing but helpful accomplices are all that is necessary. You say you don't believe it? Well, read the book and Ed Yourdon will show you how simple it is.

This explains the $3 million that you, Bernie Kaplan, have stumbled upon. In the second half of the book, some very determined people get on the trail, including the FBI, NYPD, bank auditors, a good friend and the thief who originally stole the $3 million. All would dearly love to track down Bernie and the $3 million. Although Bernie is no dummy, he is no match for the thousands of computers that keep track of every imaginable type of transaction. Pay for a hotel room in cash? It's recorded. Take a book out of a library? It's recorded. Airline and train tickets? All recorded. Credit cards? Obviously recorded.

It all comes to a head when two of the searching groups get together and learn about the existence of the original embezzlement and ...

Find out for yourself! *Silent Witness* is perhaps the most realistic and compelling novel that I have ever read in which

computers play a central role. No, the story is not as complex as Ludlum or MacLean would write, but in one sense it is a great deal scarier: what is a fictional story today could happen for real tomorrow—or maybe it already has.—*DHA*.

Video Invaders by Steve Bloom. Arco Publishing Inc., New York, NY. 220 pages, $10.95, 1982.

Having seen my share of quickie softcovers, purporting to reveal everything from inside strategy to in-depth analysis of the video game phenomenon, I have become rather wary of any book containing the word "video" in its title.

When I began reading *Video Invaders*, I thought my worst fears had been confirmed. The book is written in *videolect*, an informal style of growing popularity, wherein the tone is so conventional you can almost hear the author snapping his gum. Though I felt a case of the cutesies coming on, I persevered.

It was worth it. Despite occasional lapses, *Video Invaders* is on the right wavelength. It does the job of imparting the fervor of videophiles, without losing all perspective concerning the games themselves. Among its most compelling features are interviews with game inventors and an inside look at Atari.

Bloom begins with a retrospective—a look at the state of the arcade before the advent of video games. The video game boom resuscitated an old and established arcade tradition, which floundered for some time before *Invaders* made its appearance. It is a tradition which has withstood attacks before.

The author asks a tough question, one we've looked at ourselves: Who invented the video game? He equivocates a bit on the question, and asserts his conclusion with a "would you believe" and a question mark. It is just as well, since he is able only to trace back as far as the mainframe computers at Harvard and MIT in the early sixties. (Our research uncovered a video game designed in 1958, by Willy Higinbotham. It ran on a small oscilloscope using an analog computer.)

Still, Bloom admirably traces video game history from Pong to the present day, and the story is fascinating and well told.

The author allows others to tell their own stories, and the longest chapter of the book is devoted to just this. Eight different game designers speak frankly and freely about the business—where they have been, where they are, and where they would like to be "on down the road." As I read this section, I gained some insight into a few of the minds that engineered the video game revolution.

Following this chapter is a look at Atari, or as Bloom puts it, the "IBM of the game world." It is the frankest and most complete profile you are likely to see concerning the corporation. The author toured Atari, and reports on his findings in detail. I found the chapter not only interesting, but also somewhat awesome: the growth of the company has been phenomenal.

The "problems" of video games are also examined, and while the author labels most of the anti-video attacks as "moralistic balderdash," he underscores the need for some regulation. He goes on to point out some extremely promising

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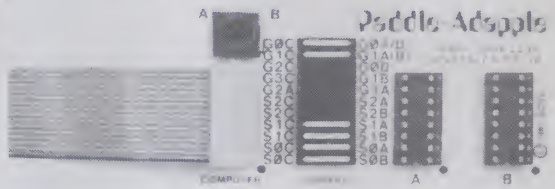

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uses of video game technology in education and therapy.

It is a requirement for books of this ilk to include a section on beating the games. This one is no exception, and though coverage is a little uneven, readers are bound to pick up at least a few pointers. One very good one is never to bring more than $10 in quarters to an arcade in a single visit.

Video Invaders may be but one of many books of its kind (this kind has appeared like mushrooms on a wet lawn), but it is one of the better ones I have seen, and one of the very few worth reading all the way through—*JJA*.

Problem-Solving on the TRS-80 Pocket Computer, by Don Inman and Jim Conlan. John Wiley & Sons Inc., New York. 261 pages, paperback $8.95. 1982.

One of Wiley's latest Self-Teaching Guides, this has a title that's a little misleading; the book teaches the Radio Shack TRS-80 PC-1 Pocket Computer (or Sharp PC-12ll) from the ground up, rather than getting right into problem-solving. However, it does assume some knowledge of Basic, and doesn't spend much time on statements and commands common to other computers.

The first six chapters teach how the PC-1 operates, and get into memory use, definable mode, error codes, editing, cassette use, data files, trig functions, operation time, logic functions, and binary bins.

The next three chapters look at applications: Feedback and Systems (computer-show attendee flow, war-game problem, etc.), Random Walk, and Computing Interest. The last three chapters get back into using the PC-1, for Storing, Sorting and Searching; Chaining Programs from Cassette; and The TRS-80 Pocket Computer Printer.

Five appendixes provide a list of Basic statements and commands, special Basic functions, acceptable abbreviations, error codes, and printer terms.

The writing style is informal, with comments such as "Note: We didn't say tuck the computer into your *back* pants pocket. The...display...is made of glass. If you sit down with it in your back pocket, you may crunch the LCD." The authors are very thorough, and explain every facet of the PC-1 in clear, easily understood writing, and with many helpful illustrations and examples of LCD and printer displays. This is the sort of book Radio Shack should have provided with the PC-1.

Invitation to Forth, by Harry Katzen, Jr. Petrocelli Books Inc., Princeton, NY. 244 pages, hardcover $17.50. 1981.

"Forth is a language for doing functional programming, with specific orientation towards productivity, reliability and efficiency. Included in its capabilities are structured programming, top-down development and virtual memory. However, Forth is not merely a focal point for popular concepts. It represents a modern way of approaching programming. The structure of a Forth program and the Forth language itself is based on reverse Polish notation or post-fix notation as some computer scientists call it. This basic philosophy combined

with an effective definitional structure permits a high degree of language flexibility and the ability to customize the language to the requirements of a particular application environment," according to the dust jacket.

The book assumes familiarity with programming, having been written as an introduction to Forth "for computer professionals, engineers, business analysts, and the creative and energetic group of microcomputer enthusiasts."

After a brief introductory chapter on RPN and the concept of Forth, the author goes into Computer Fundamentals; Software Technology; RPN; Elementary Calculations and Stack Manipulation; Constants, Variables, and Memory Operations; Definitions and Terminal Operations; Control Structures; Double Precision; and Information Management. Each chapter ends with a few exercises; the answers are all at the end of the book.

The writing is in a formal, compact, no-nonsense style. The text is one of the very few books printed on a dot-matrix printer; without descenders, the font isn't all that easy to read, but those who want a good grounding in Forth won't mind all that much, because the book is well worth the extra effort required to read it.

Inversions: A Catalog of Calligraphic Cartwheels, by Scott Kim. Byte Books, division of McGraw-Hill, Peterborough, NH. 123 pages, paperback $8.95. 1981.

Written by a doctoral student in Computer Science at Stanford University who is also a concert pianist and composer (according to the Byte catalog), this fascinating collection of letters and words turned into art was in part generated with the help of a computer graphics language.

The book is full of "intriguing designs, words that read the same right-side up and upside down, words-within-words, and unexpected symmetries," to quote again from the catalog. There are over 50 illustrations to admire, to wonder how they were created, to Xerox for friends, and to wish one had the talent to create.

Equally fascinating to the computer-freak is the text that follows the illustrations, in which the author first discusses symmetry, vision, letterforms and processes, then looks at some examples in detail, the canon as the musical analog of inversion, palindromes, and the works of Escher. The book ends with comments on each illustration and a bibliography of three dozen books on subjects ranging from designing with type to Bach.

This is a fine gift book for artists, computerniks, or anyone who loves beauty in mathematics and design. Or to keep for yourself, as delightful examples of how far the imagination can be stretched. □

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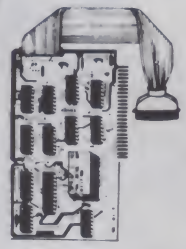

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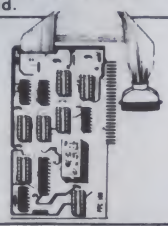

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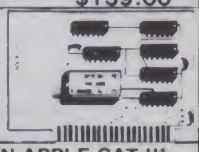

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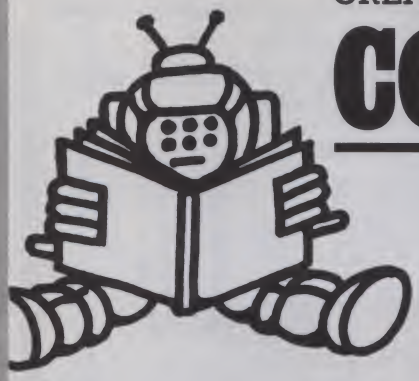

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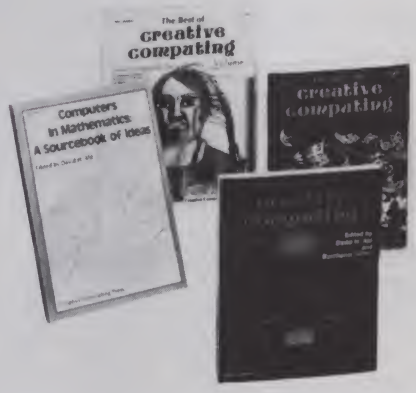

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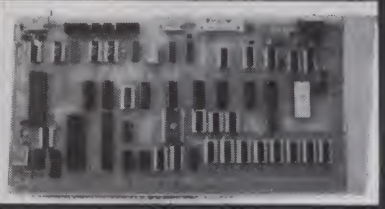

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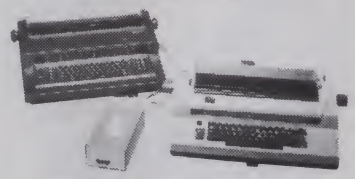

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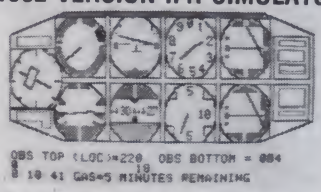

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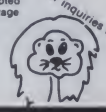

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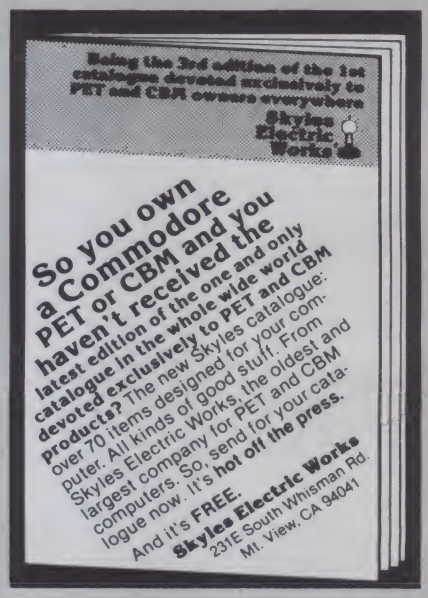

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